

ANNALS of SURGERY

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SURGICAL SIGNIFICANCE OF ABDOMINAL PAIN	1
ARTHUR E. BILLINGS, M.D.	PHILADELPHIA, PA.
ENDOTHERMY IN NEOPLASTIC DISEASES	2
GEORGE A. WYETH, M.D.	NEW YORK, N. Y.
ENCAPSULATED ADENOMATA OF THE THYROID	20
JOSEPH L. DECOURCY, M.D.	CINCINNATI, OHIO
BACTERIOLOGY OF EXTIRPATED TONSILS	25
T. NAKAMURA, M.D.	ROCHESTER, MINN.
FOCAL INFECTION IN ULCER OF THE STOMACH	29
T. NAKAMURA, M.D.	ROCHESTER, MINN.
GUMMA OF THE BREAST	35
FRANK E. ADAIR, M.D.	NEW YORK, N. Y.
LIVER AND CHRONIC ABDOMINAL INFECTION	35
CHARLES GORDON HEYD, M.D.	NEW YORK, N. Y.
RECONSTRUCTING AN INJURED ANOMALOUS HEPATIC DUCT	77
WALTMAN WALTERS, M.D.	ROCHESTER, MINN.
RUPTURE OF THE SPLEEN	80
J. C. MCCracken, M.D.	SHANGHAI, CHINA
ACUTE PERFORATED ULCER OF THE STOMACH	91
JOHN A. MCCREERY, M.D.	NEW YORK, N. Y.
ASEPTIC TECHNIC FOR RESECTION OF INTESTINE	100
CYRUS F. HOMER, M.D.	BALTIMORE, M.D.
UTERUS DIDELPHYS	103
FRANCIS C. NEWTON, M.D.	BOSTON, MASS.
ENCYSTED FOREIGN BODIES	114
FRANK PASCHAL, M.D.	SAN ANTONIO, TEXAS
SACRAL ANÆSTHESIA	116
EDWARD C. BRENNER, M.D.	NEW YORK, N. Y.
INSTRUMENTARIUM FOR LOCAL ANÆSTHESIA	124
WILLIAM R. MEEKER, M.D.	ROCHESTER, MINN.
TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY	130
STATED MEETING HELD OCTOBER 1, 1923	
TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY	143
STATED MEETING HELD OCTOBER 10, 1923	
BOOK REVIEWS	154
CORRESPONDENCE: O'Connell: Crippled Joints and Flat Feet. Trench: The Treatment of Pregnancy and Gall-bladder Disease in the Parturient	155

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No. 1

SURGICAL SIGNIFICANCE OF ABDOMINAL PAIN

By ARTHUR E. BILLINGS, M.D.

OF PHILADELPHIA, PA.

OF THE many and varied surgical conditions which we encounter in the abdomen, pain is the most important symptom and the one which more often influences the diagnosis and procedure than any other.

To correctly interpret its meaning as a symptom, one must have a fairly intimate knowledge of the rather complex nerve supply of the entire abdomen and its contained viscera before its significance is fully understood. It is aside from the subject for discussion to go into the detailed anatomy and physiology of the nerve supply of the abdomen at this time. However, I feel that it will not be out of place to refer to the main sources of innervation. The abdominal parietes, front and sides, are supplied by the lower five or six intercostal spinal nerves which give off anterior and posterior branches and terminate by entering the substance of the rectus muscle on each side and giving sensation to the mid-front of the abdomen. The hypogastric region and lateral flanks are supplied by the last dorsal and branches of the ilio-hypogastric and ilio-inguinal nerves. It is interesting to note that the posterior wall of the abdomen receives its supply from the lumbar and sacral spinal nerves and not the dorsal. These branches are intimately connected with the lumbar and sacral plexi which lie on the posterior wall of the abdomen, and are in close relationship with many of the viscera which are the frequent site of disease and of which, when inflamed, pain is often the most conspicuous symptom. In addition to this, we have several large main nerve trunks entering the abdominal cavity which are closely connected with the other large distributing centres. The pneumogastrics on each side of the œsophagus go to supply the stomach, the right to the posterior wall of the stomach, entering into the formation of the solar-plexus, and the left to the anterior wall. The sympathetic enters the abdomen as two large trunks beneath the pillars of the diaphragm and pass into the pelvis ending in the coccygeal ganglia, having entered into the formation of several small ganglia (four lumbar, four sacral) which are the connecting stations between the various large sympathetic abdominal plexi on the inner side and the spinal nerves externally. There are three other important trunks on each side passing from the thorax into the abdomen, *viz.*: the great, the small and smallest splanchnics which go to make up the semi-lunar ganglia and renal plexi. The phrenics, two other spinal nerves, descending principally from the fourth cervical through their

anastomotic branches communicate with the solar and hepatic plexi and in this way have visceral connections, but strictly speaking do not enter the abdomen but supply the diaphragm, a not infrequent seat of baffling pain from the standpoint of diagnosis.

Next in consideration is that intricate interlacing of nerve fibres of the sympathetic system lying immediately upon the aorta, and at two points they are much more closely aggregated and constitute the great solar and hypogastric plexi. The epigastric or solar plexus is situated behind the stomach and in front of the aorta and crura of the diaphragm. It receives the great and small splanchnics and the termination of the right pneumogastric and supplies all of the viscera of the abdominal cavity from its ten distributing centres or lesser plexi.

The hypogastric plexus located in front of the fifth lumbar vertebra occupies the same relative importance to the pelvis and its organs as does the solar to the abdominal viscera. It will be observed that the nerve supply of the viscera and visceral peritoneum is derived from the various sympathetic plexi while that of the parietal peritoneum is derived directly from the spinal nerves (dorsal, lumbar, sacral and phrenics). The spinal nerves contain many more sensory fibres than do the sympathetic trunks. It is a long established clinical fact that the parietal peritoneum is much more sensitive to manipulation and the traumatism of surgery under local anaesthesia than is the visceral peritoneum, or in fact any of the viscerae. This fact must also be remembered from a diagnostic point of view.

Before going further, it is necessary to refer to the connection that exists between the visceral nerve supply and that of certain well-defined areas on the body surface supplied by the spinal nerves and related through the same spinal segment. The brilliant works of Head, Ross, MacKenzie and others, but Head in particular, has resulted in establishing the exact relationship between sharply defined cutaneous tracts and viscera receiving their nerve supply through the sympathetic, but from the same spinal segment as that received by the skin area. I quote from Head, "On disturbances of sensation with especial references to the pain of visceral disease." * * * "Pain was in many cases associated with definite cutaneous tenderness: Moreover, the cutaneous tenderness was in many cases not confined to small spots or areas, but occupied whole tracts of skin with definite tenderness. I was then led to investigate the pain and accompanying tenderness consequent on disturbances of other organs, and I found that these sensory disturbances also followed definite lines. After Ross' most suggestive papers it seemed exceedingly probable that these areas bore some definite relation to nerve distribution, and I then began to investigate the distribution of herpes zoster in the hope that a skin lesion which was notoriously of nervous origin might throw some light on the meaning and significance of tender areas in visceral disease. I next attempted to determine to what level of the nervous system these areas belonged, with the help of cases in which gross organic lesions were present. By this means it became apparent that each of these areas represented the distribution of a single nerve

SURGICAL SIGNIFICANCE OF ABDOMINAL PAIN

root or of a single segment in the spinal cord. Thus I was enabled to map out the areas supplied by the various segments of the cord on the surface of the body. It then became apparent that certain of these areas were never affected in visceral disease, and this led me to examine the sensory supply of the viscera from the sympathetic system. Now Ross had already suggested that in visceral disturbances, pain (and therefore, in my cases tenderness) was referred along the distribution of the somatic nerves which come off from the same part of the cord as the sensory sympathetic fibres to the organ affected. Thus if I could map out the somatic areas along which pain was referred in visceral disease, I could say on Ross' hypothesis what was the sensory supply from the sympathetic of the particular organ affected. By this means I obtained another scheme showing the distribution of the sensory sympathetic fibres analogous to that which Gaskill constructed for the motor and inhibitory fibres of the same system."

It is interesting to note that in this surface topography, the cutaneous zones correspond more closely to segmental supply than to individual nerve supply; also the cutaneous zones are sharply defined and do not overlap as in the ordinary peripheral sensory supply to the skin. This most interesting work of Head's explains referred surface pain in visceral disease and enables us to follow it in many vague conditions to the affected viscera. Under normal conditions pain in the skin is located with accuracy at the point receiving the stimulant, as for instance a pin prick on any part of the body surface. This, to a large degree, is attributed by Howell to the temperature and pressure sense, and when these are lost or destroyed in the skin surface, pain is then very inaccurately located. "Pain arising in the internal organs on the contrary is located very inaccurately, but is often referred to points on the skin, and may be accompanied by areas of tenderness in the skin." Pain of this kind, when misreferred to the surface of the body, is designated as reflected pain. The explanation offered for this (Howell) misreference, is that the pain is referred to the skin region that is supplied by the spinal segment from which the organ in question receives its sensory fibres, the misreference being due to a diffusion in the nerve centres. As Head expresses it, "when a painful stimulus is applied to a part of low sensibility in close central connection with a part of much greater sensibility, the pain produced is felt in the part of higher sensibility, rather than in the part of lower sensibility to which the stimulus was actually applied."

It is interesting that affections of the serous cavities, *e.g.*, the peritoneum, do not cause reflected pains or cutaneous tenderness as in the case of the viscera. Another important fact in referred pain is its occasional occurrence in the symmetrical area on the opposite side of the body. This is sometimes seen in renal disease, ovarian lesions, tubal pregnancy and breast inflammation, and is explained on the basis that depression of the cutaneous sense in a given area with application of the stimulus to that point, will cause pain projection to the symmetrical area of the opposite side; if this is also involved it may be referred to the area next above or below in the spinal order. On

more than one occasion we have found a stone in the opposite kidney or a rupture of the opposite tube in ectopic pregnancy to what was expected from the patient's localization of pain. The stimuli necessary to excite pain varies in different parts; for instance those for visceral pain are not of the ordinary thermal or tactile types to which skin and mucous surfaces respond so promptly, but is believed by most investigators to be entirely due to tension in some form or other. Meltzer has attempted to explain all forms of colic on the basis of what he terms "the law of contrary innervation," which in the normal physiological peristalsis of the intestine is fulfilled in the simultaneous relaxation that always occurs just below the contracting segment. When this simultaneous contraction and relaxation is interfered with by the presence of inflammation, new growth or other disturbing lesions, pain is the result. The contraction of unstriated muscle is the most frequent cause of abdominal pain and it is always referred along the midline of the abdomen somewhere from the ensiform cartilage to the pelvis. This is the reference segment for all of the hollow viscera, cesophagus, stomach, intestine—and includes bladder, uterus and bile ducts—while renal colic is distinctly unilateral in its reference.

When we come to consider the various surgical conditions of the abdomen which may be the cause of pain, we can only allude to the most important in a general way in the time at our disposal. Some of the lesions are chronic, others sub-acute and many are acute, depending upon the degree of severity and duration. Many acute conditions are but sudden and severe exacerbations of preëxisting disease. It has been estimated that 90 per cent. of all disease begins with, or is accompanied by pain sometime during its course. "Alone, pain indicates danger in general, in combination with other signs it indicates danger in particular and guides the surgeon's hand to its source." In many cases it is the most important symptom. In others, it is only an incident. Its location, the manner of onset, severity, duration, radiation, the relation it may have to certain events like the taking of food, micturition, defecation, etc., demand careful consideration in their interpretation. It may be worse at night. Its relation to other symptoms such as vomiting, etc., must be given due thought. For certain lesions the severity, character and location may be quite typical. Age, racial characteristics and sex are entitled to consideration. Women as a rule endure pain better than men because of lessened sensibility to painful stimuli, and the phlegmatic are more uncomplaining than those with a highly developed nervous system. It is a well established fact that in the aged there is occasionally an absence of pain in many of the lesions, such as appendical and gall-bladder inflammations which are ordinarily productive of a great deal of pain. This is explained on the basis that in senility the sensibility to painful stimuli is lost to a great degree and sometimes completely. In the obese patient, tenderness and rigidity may be diminished or absent from anæsthesia of the peritoneum as a result of fat deposit about the somatic nerve endings in the sub-serous space. The patient's interpretation of the character of pain may be of considerable value in arriving at the cause. Pain ought always to be regarded from two aspects: In the one, the untouched patient

SURGICAL SIGNIFICANCE OF ABDOMINAL PAIN

manifests it, and in the other, the clinician elicits it. In the latter it is pain on pressure or tenderness which is always located about the seat of the lesion. Crile states: "Pain, like other phenomena, was probably evolved for a particular purpose, surely for the good of the individual; like fear and worry, it frequently is injurious. What then, may be its purpose? We postulate that pain is one of the phenomena which results from a stimulation of motor action." He also maintains that the only types of infection that are associated with pain are those in which the fixation of parts by continued muscular rigidity is an advantage, that the type of infection that may cause muscular action when it attacks one region of the body, may cause no such action when it attacks another. A striking instance of the protective action of pain is seen in acute abdominal infections such as peritonitis, where there is segmental rigidity of the recti muscles in localized infections or generalized rigidity in diffuse infections. Peristalsis is almost absent, food is refused or may be ejected, the dorsal position is assumed and is not often changed. Muscular action has an adaptive and protective purpose in these infections.

The perforating lesions of the stomach, duodenum, appendix and rarely the gall-bladder, cause that type of pain which should not be interpreted as meaning anything but the gravest sort of intra-abdominal lesion, the sudden onset, the terrific and unabating pain with board-like fixation of the abdominal muscles is characteristic. The pain of acute pancreatitis and mesenteric thrombosis are equally severe and may not be relieved by heroic doses of morphine. In these lesions, life is at once jeopardized by the intense suffering. In pancreatitis the pain is confined to the upper abdomen and nearly always passes with severity to the back. It is agonizing beyond endurance and frequently is the cause of collapse. In the gastric and duodenal perforations, the history of the patient's condition previous to acute onset will, in a majority of cases, suggest quite accurately the nature and location of the lesion. This is particularly true of duodenal ulcer, where pain comes on one, two or three hours after taking of food and which is gnawing or burning in character and is relieved by taking more food or alkalies for a time and is often described as hunger pain. The distinct periodicity to the pain and symptoms is another characteristic. In gastric ulcer pain is less characteristic as a rule, and is generally aggravated by taking food. It is burning or scalding in character, is usually felt about the ensiform cartilage and is frequently referred to region of twelfth dorsal vertebra.

In gall-bladder inflammation the pain is never so severe as that of the perforating lesions mentioned. A frank perforation of the gall-bladder with sudden soiling of the whole peritoneal cavity, as is seen in gastric or duodenal perforation, rarely occurs. When perforation takes place, it is usually walled off and because of its anatomic position, results in a localized inflammation. Pain is not so severe and is localized as is tenderness. In gall-bladder disease the character of pain may be variable. It may be that of an acute inflammation, the result of severe infection, which is accompanied by abdominal rigidity, tenderness and the other signs of acute inflammation; or it may be the pain

of tension due to distention of the gall-bladder, chronic infection and the presence of stones. Tenderness in these cases can nearly always be elicited by palpation over the gall-bladder. Referred pain may exist with either of the above conditions. The pain of gall-stone colic is usually intense, recurring in violent paroxysms and is referred over the hepatic and epigastric regions and usually radiates to the back or right shoulder. Vomiting, with profound nausea, is nearly always an accompanying symptom. Rarely the pain is referred to the left side and back.

The pain of peritonitis is sharp, stabbing or lancinating in character. Patients frequently describe it as having "doubled them up." There is, of course, generalized tenderness and muscular rigidity over the involved peritoneum, and usually a point of maximum tenderness can be elicited about the site of the primary inflammation. Pain, resulting from inflammation of the vermiform appendix is usually abrupt in onset. It is of varying degree in severity. It is usually referred to the epigastrium or around the umbilicus and after the lapse of a few hours usually becomes distinctly worse in the right iliac fossa. The sequence of pain to other events is of great importance in the diagnosis of appendicitis. Pain is always the first symptom, and if pain is preceded by vomiting you can almost certainly exclude disease of the appendix. The pain is apt to be colicky in character until involvement of the peritoneum takes place, when its character may be somewhat changed. It may seem a little out of place to refer to purgation in these cases, but having seen so many disastrous results from it, I cannot refrain from mentioning it. It is unquestionably the cause of most of the cases of peritonitis that we see resulting from this disease. If these patients are not purged there is the same tendency for the inflammation to remain localized even if perforation does occur, as is manifested in infections of the gall-bladder and pelvic appendages. Moynihan says that in appendicitis, perforation spells purgation, and in his large experience he pens the sequence of events in pain, aperient, perforation. He further says: "I, therefore, do not hesitate to say that in almost every instance of acute peritonitis due to the perforation of the appendix it is the treatment directed to the relief of the condition that is the cause of the serious and so often fatal catastrophe." He has expressed himself most clearly and forcibly in an amended nursery rhyme:

Perforation means purgation,
With the appendix kinked and bad;
Both food and drink will worry him
And aperients drive him mad.

Diseases of the pelvic appendages in the female is a common source of pain. A bi-manual examination should never be omitted, especially when a woman complains of backache. An ovarian cyst, a pus tube, or a right ureteral stone is often diagnosed as appendicitis; and a lacerated cervix or perineum with a retroverted or prolapsed uterus treated for kidney disease or lumbago. Pain of these organs is often described as "bearing-down pain or

SURGICAL SIGNIFICANCE OF ABDOMINAL PAIN

heavy headache." Pain may also be reflected down the front of the thighs. The pain of ruptured ectopic pregnancy is usually severe in character but does not approach the intensity of the perforating lesions that we have described. The pain, of course, is more severe over the lower abdomen, and is occasionally located on the opposite side of the rupture. Patients sometimes describe it as "if something had given way or had burst within the body." The pain of intestinal obstruction is usually sudden in onset. It is violent in character continuous with fierce exacerbations. The continuous pains are due to the constriction of the intestine and the exacerbations to the colic of an over-active peristalsis.

The location of pain varies with the site of obstruction. It has been shown by MacKenzie that the pain of obstruction is always located along the mid-line of the abdomen, the zone for the small intestine embracing the umbilical region corresponding to the levels of the costal margin above and the crest of the ilium below; while that of the large intestine occupies the hypogastrium. One may be aided in the localization of this pain by remembering that it begins well above the point of obstruction, gradually passing lower and lower until it reaches a climax. If, when the pain stops, this part be noted, the situation of the obstruction can be localized within certain limits. Unfortunately the limits are still wide, nevertheless, the information is extremely useful as an aid to diagnosis.

The pain of tuberculous peritonitis and localized tuberculous processes is not in any way characteristic, but is usually either sharp and stabbing in character like that experienced in other infections of the peritoneum, or else it is colicky in type due to interference with peristalsis or involvement of the intestinal tract. There are many other less common surgical lesions of the abdomen, including ureteral calculi, intestinal tumors, mesenteric cysts, eroding and ruptured aneurisms and typhoid perforations, etc., which we will not take up.

In the examination of a patient for the purpose of eliciting pain or tenderness, one must not forget the influence of position on pain in the various organs. The occurrence of a painful position points to a localized process. This is frequently found to exist even when the pain appears to be diffuse as in acute appendicitis. Painful position may be present in cancer, gall stones or stone in the pelvis of the kidney. The lateral position is frequently found to be painful for it involves the most favorable conditions for abnormal displacement and traction if tumors or adhesions are present. The influence of motion is of considerable value in acute inflammatory and suppurative conditions of the abdomen as when the patient anxiously maintains the dorsal position and carefully avoids turning to either side. A transmitted jar from walking or going down steps will frequently cause pain when there is present a pyonephrosis and appendicial abscess or acute inflammation of the gall-bladder.

In the consideration of abdominal pain one must keep constantly in mind the many extra-abdominal conditions which so closely mimic many of the

acute abdominal lesions. Among the most conspicuous of these are the referred pain of pneumonia, pleurisy, diaphragmatic infections, acute dilatation of the heart, gastric crisis of tabes dorsalis, acute coxitis of children, spondylitis, herpes zoster and angina pectoris. The abdominal symptoms of the latter condition is sometimes described as angina abdominis. Some of the more common non-surgical intra-abdominal conditions such as lead poisoning, acute gastritis, colitis, etc., may be excluded in the diagnosis of a surgical lesion by careful history taking and a proper correlation of symptoms with thorough physical examination. There are conditions in which a positive pre-operative diagnosis cannot be made other than that of an acute abdominal catastrophe. In these cases, with the use of all diagnostic means at hand, accurate interpretation of history and symptoms and a proper display of surgical judgment, a timely operation may be performed or an operative casualty averted.

Some one has classified the causes of pain into (1) muscular, such as is seen in the passage of ureteral or biliary calculi; (2), that caused by irritants of a chemical or microbic nature, such as is seen in peritonitis from perforation of a gastric or duodenal ulcer or gangrenous appendix; (3), from undue distention of encapsulated organs such as the liver, spleen, pancreas, kidneys, ovaries, etc. This distention may be due to abscess or cystic formation, or the infiltration of new growth or inflammation; and lastly where the source is found in the invading process of an aneurism where the pressure is from without or there is erosion and exposure of nerve trunks.

When we remember that these complicated plexi and network of nerve trunks, leading to and from the abdomen conveying all kinds of nervous impulses, some motor, some sensory, many secretory and others vasomotor, and maintaining such an intricate relationship one with the other, and all with the whole nervous mechanism, it is well nigh impossible not to believe that when any material disturbance is brought to bear upon a particular plexus, through undue stimulation of a part supplied by its nerves that a much wider effect must be produced than would otherwise be the case, if no such association existed. With such considerations in mind, it is possible to see some explanation of the many and varied phases which the same disease may present in different individuals. In one case motor derangement may feature the disturbance, and in another it will be altered secretions, and in still another sensory or vasomotor symptoms will predominate.

I wish to make grateful acknowledgment to such authorities as Head, MacKenzie, Ross, Crile, Moynihan, Howell, Meltzer and Richardson, whose works I have used freely in the preparation of this paper.

ENDOTHERMY IN THE TREATMENT OF ACCESSIBLE NEOPLASTIC DISEASES*

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To us as medical men, not the least interesting feature of the history of electricity is the fact that much of the original experimentation has been done by physicians. Ever since Dr. William Gilbert published in 1600 his work "De Magnete"

and laid the foundations of modern conceptions of electricity, physicists and physicians have been attracted by this great force and its possible service to man. Nearly two hundred years later Galvani, an Italian physician and professor of anatomy, accidentally discovered the muscular contractions produced by the current to which he gave his name, and before the middle of the nineteenth century—about the time that Faraday was announcing his discovery of induction—Joseph Henry, an American, described the oscillatory character of

the discharge from the Leyden jar. Henry not only understood the oscillatory nature of these waves, but proved experimentally that a spark about one inch in length from the prime conductor of an electrical machine to a wire circuit in an upper room, produced inductive effects capable of magnetizing needles in a parallel circuit placed in the cellar, although this was thirty feet below the upper floor and separated from it by two floors each fourteen inches thick.

This demonstration did not attract further attention until it was taken

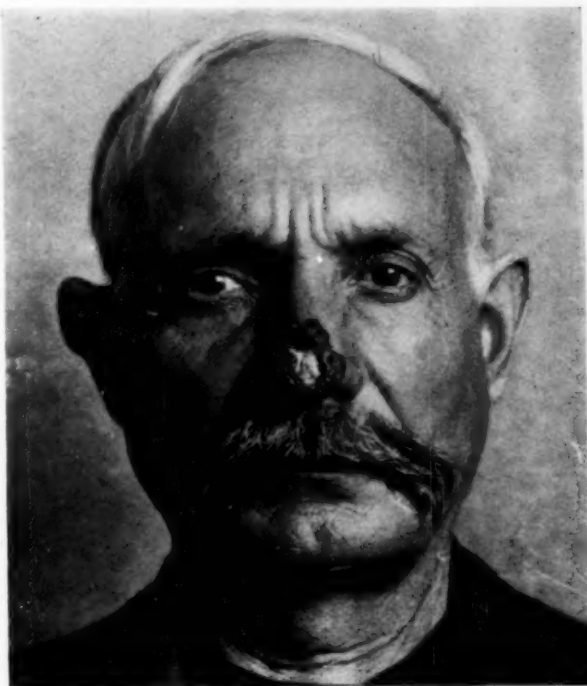


FIG. 1.—Basal cell epithelioma of nose. Given single treatment by monopolar endothermy under local anæsthesia on June 26, 1922.

* Read before the Medical Society of the County of Queens, April 24, 1923.

up by Hertz in 1888, when he succeeded in producing a series of electric oscillations of very high frequency. Whereupon D'Arsonval showed that muscular contractions cease with 10,000 oscillations per second and this number has therefore been taken as the dividing line between currents of high frequency and low frequency. In demonstrating the lack of effect of such oscillations on motor or sensory nerves, he used an apparatus which was first suggested by Sir Oliver Lodge.

Doyen, whose researches on the penetration of heat began in 1896, presented to the French Surgical Congress in 1907, a well-thought-out method



FIG. 2.—Patient shown in Fig. 1. Picture taken on July 10, 1922, fourteen days after treatment, showing lesion completely healed. No recurrence to date, September 1, 1923.

of destroying accessible cancer by electro-coagulation, and one of his important conclusions was expressed as follows: "Of all means employed in the destruction of pathological tissues the only certain method is that of heat."

Colwell, in his book "History of Electrotherapy and Diagnosis," tells us, "The actual production of heat within the tissues themselves, as the result of the passage of an electric current of high frequency was first suggested by Nikola Tesla in 1891. D'Arsonval, in February of that year, made a communication to the Societe de Biologie

in which he stated the possibility of passing a high frequency current of three amperes through the body with no other sensation than that of heat, and in 1908 Nagelschmidt, at the Buda-Pesth Congress, demonstrated a specially designed apparatus for producing this heating effect and introduced the name *Diathermy*."

This was fifteen years ago, and those of us who are now working with neoplastic growths, feel that too much time has been wasted in contradictory literature and vague nomenclature. This is partly because neither apparatus nor technic has been standardized, and because much of the work has been done by specialists in other fields, whose limited leisure gave little chance for the development of skill in the use of these special instruments.

ENDOTHERMY IN NEOPLASTIC DISEASES

Neoplastic diseases are of many forms and of varying degrees of virulence, and before the practitioner can be successful in their treatment by high frequency currents, he must be wise in the currents' prescription and expert in their application. We cannot be either wise or expert if we are inexact. We must not talk of fulguration, high frequency cauterization, desiccation, electrothermic cautery, sparking, thermo-penetration, the electric needle and coagulation as if they were all words indicating more or less the same process.

Nagelschmidt's use of the term "surgical diathermy" represented an effort at exactness, but we need consider it only a moment to realize that it is both limited and limiting. Nagelschmidt knew nothing of desiccation, that more important branch of endothermy, which was devised and has been so brilliantly developed by Dr. Wm. L. Clark of Philadelphia. In the old technic of Doyen and Nagelschmidt a round plate blunt electrode was used for the active electrode which caused needless wide-spread destruction and was moreover, beyond the control of the operator. This old technic is still used by many, but it is not employed in endothermy.

Of desiccation, or *monopolar* endothermy, Doctor Clark writes:

"Desiccation should not be confused with fulguration, or with high frequency cauterization, or coagulation. Desiccation devitalizes by drying the tissue; fulguration shocks and produces hyperæmia but does not destroy; high frequency cauterization is essentially the same as the ordinary cautery, though perhaps deeper in effect. It is possible to produce all thermic degrees ranging from hyperæmia to cauterization. The desiccation spark is not hot enough to carbonize, but is of sufficient heat to cause rapid dehydration of the tissue, rupturing the cell-capsule and converting the area treated into a dry mass. Desiccation destroys tissue without opening blood or lymph channels and will act as a styptic when there is oozing of blood."

Dr. W. Benham Snow has said: "Oscillary desiccation as practiced by



FIG. 3.—Large, basal cell epithelioma of eight years duration at inner canthus of left eye, involving upper and lower lids and conjunctiva over inner aspect of eye. Treated by monopolar endothermy under local anæsthesia.

Doctor Clark requires a more precise technic with more skillful adjustment of apparatus than is required for fulguration and it is generally more successful."

Dr. George Pfahler says: "Fulguration is never used to destroy tissue. If the profession will get that one fact clear we shall have much less confusion in our literature."

For the sake of further definiteness, the writer has chosen to employ the word *endothermy*—*monopolar* and *bipolar*. This expresses both phases of the work and indicates its particular technic. Endothermy is the localized produc-

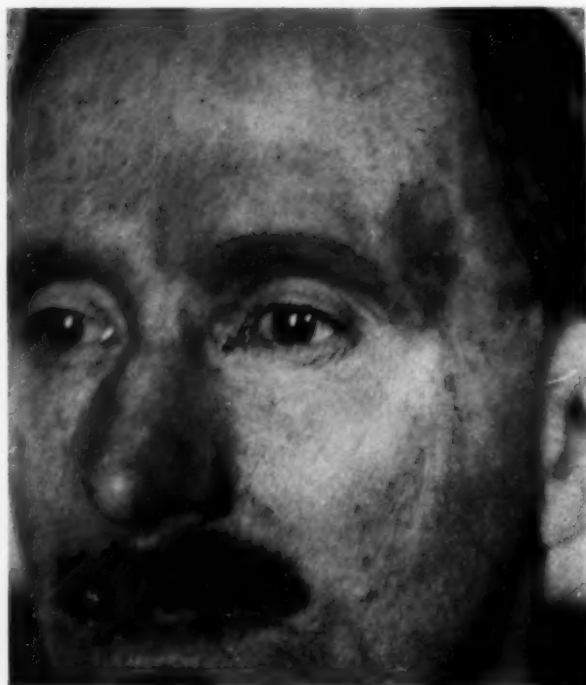


FIG. 4.—Same patient shown in Fig. 3. Showing good cosmetic result after removal of lesion. Eyesight unimpaired.

tion of heat in the tissues from within in response to the many oscillations of a high frequency current and it is always executed with a sharp-pointed active electrode. It is the purpose of this paper to outline the accomplishments of endothermy in the destruction of neoplastic diseases.

I suggest that this is of particular and peculiar interest to us all on account of the prevalence and high mortality of these cases. We know we can best control them by the employment of local attack. Systemic treatment has been discredited. Local attack may take either one of

two forms, physical or surgical. Under physical attack we place radium and X-ray, both of which have made and are daily making splendid records of relief and cure of neoplastic diseases. Both agencies can accomplish many of the results of endothermy but not so quickly nor so surely in those cases to which the latter method is applicable. This rapidity of healing is well illustrated by Fig. 1. Two weeks after removal of the malignancy by monopolar endothermy new and healthy skin covered the site of the lesion and there has been no recurrence in the fifteen months which have since elapsed.

Considering the entire range of malignancy the best hope of the patient doubtless remains in the surgeon's knife. But under surgical attack we include endothermy which has, over ordinary surgery, in accessible cases, the

ENDOTHERMY IN NEOPLASTIC DISEASES

enormous advantage of destroying the malignancy before removing it. It is impossible to overestimate the importance of the fact that with endothermy we remove the growth as a necrotic mass instead of as a group of viable cells, and thus tend to eliminate the danger of mechanical dissemination. The truth would seem to be that the varied forms of malignancy make necessary a highly specialized treatment, and it is as reckless to treat every case by X-ray as it would be to treat every case by radium or to treat every case by endothermy. The best results undoubtedly flow from wise selection and use of whatever agency, or combination of agencies may be indicated.

An important difference between endothermy and all other methods of cauterization by heat is that in endothermy the active electrode is *cold* when applied, *i.e.*, the applicator is cold when applied. Heat comes from within by the resistance of the tissues to the current. It is therefore progressively penetrating according to the amount of current used and the length of time it is applied. This progressive penetration is in contradistinction to heat applied from without, as with the actual cautery, the cold cautery or the galvano-cautery.

The three most important neoplastic diseases are tuberculosis, benign and malignant growths, and syphilis. The latter is mentioned merely to call attention to the fact that old chronic ulcerated specific lesions which have resisted treatment, often yield quickly to endothermy. This is true, also, of condylomata.

Endothermy's greatest field of usefulness is the treatment of accessible malignancy and precancerous conditions, but the method acts so surely and so beneficently in the treatment of tubercular lesions of the skin and mucous membranes that it may be considered almost a specific. This seems but little known to the profession, and when it is generally understood we shall secure better results with these most resistant cases. It should be borne in mind endothermy is a destructive process and its destructive effect can be produced



FIG. 5.—Large, basal cell epithelioma of left ear involving cartilage.

at any desired depth. Here our endeavor is to carry it to the depth of the tubercle bacilli and destroy them *in situ*. Case IV, illustrated herewith, shows a lupus vulgaris in a boy of fourteen. For ten years this had resisted every effort at eradication, but the lesion healed kindly after destruction of the tubercle bacilli by monopolar endothermy under local anæsthesia.

A lesion of tuberculosis cutis, tuberculosis verrucosus cutis and tubercular ulcer should heal rapidly after being destroyed by one treatment of monopolar endothermy. Disseminated miliary lupus and lupus vulgaris, as well as lupus erythematosus, are, on the other hand, generally more diffuse and require a



FIG. 6.—Same as Fig. 5, after treatment by monopolar endothermy, under $\frac{1}{2}$ per cent. novocaine. Note good cosmetic result.

number of treatments. Here a single area is destroyed at a time until the whole lesion is completely treated. At each treatment the epidermis over each localized area is dehydrated and peels off at once. A further penetration of the heat into the corium and subcutaneous tissue is then produced by lightly contacting with the needle. The depth to which this is carried depends upon the amount of current and length of time applied. Shortly after there is a pouring out of serum with subsequent crust formation. Under this protective crust nature restores herself.

In the lighter and more superficial neoplastic growths where the lesion is localized and does not extend into the depth of the tissues, marked destruction is not indicated and to employ surgical diathermy here would be like lifting a pebble with a crowbar. Monopolar endothermy is our method, used under local anæsthesia, preferably freshly prepared one-half per cent. novocain. The result is desiccation.

The technic is easy. With the monopolar current, a current of high voltage and low amperage, from an Oudin resonator of a high frequency machine we induce in the tissues just enough heat to cause a localized dehydration. This is done with an ordinary sewing needle held in a suitable handle. Our new machines allow us to employ the heat where we will and to what degree we will in all accessible lesions. Throttled down to a pinpoint area we

ENDOTHERMY IN NEOPLASTIC DISEASES

can work in the cornea of the eye or on the vocal chords. For this work our needle should only touch or rather lightly penetrate the lesion to be destroyed, and we have found the method unsurpassed for removing those small tumors of the eyelid which can be taken off at their bases without destroying the surrounding tissue. The treatment is followed by practically no scar formation and consequent ectropion. This superior cosmetic result follows because, though endothermy is a destructive process, it neither chars the flesh nor burns it, and there is therefore only slight secondary inflammation. For this reason it is especially valuable in the removal of lesions about the face, neck and

hands. Warts, moles, pigmented nevi, papillomas, keratoses, those commoner blemishes which, unsightly in themselves, are menacing because they may become malignant, all are easily removed by endothermy. Doctor Pfahler says:

"He who has once seen a mole treated by this method will not think of using any other by preference. The results are prompt, not very painful, and beautiful." The many kinds of warts are taken off without troublesome hemorrhage, and particular mention should be made of the ease and permanence with which that some-

time persistent plantar wart, with its underlying spongy layer, is eradicated by this treatment. That obstinate condition, leucoplakia, also responds to the brushing over of this current, as does vernal catarrh. Varicose ulcers and old, chronic, indolent ulcerations which are sluggish in healing often respond rapidly to a treatment by endothermy. Here we thoroughly desiccate all old stubborn granulating tissue and curette down to a healthy base. The heat sterilizes the wound and by removing all obstructive debris we give nature a fresh start. Cases II and III show, respectively, epithelioma of eyelid with inner canthus, and ear. Both of these were treated by monopolar endothermy, under local anæsthesia, according to the technic just described. In each case nature's healing was prompt and uninterrupted and the cosmetic result highly satisfactory. Particular interest

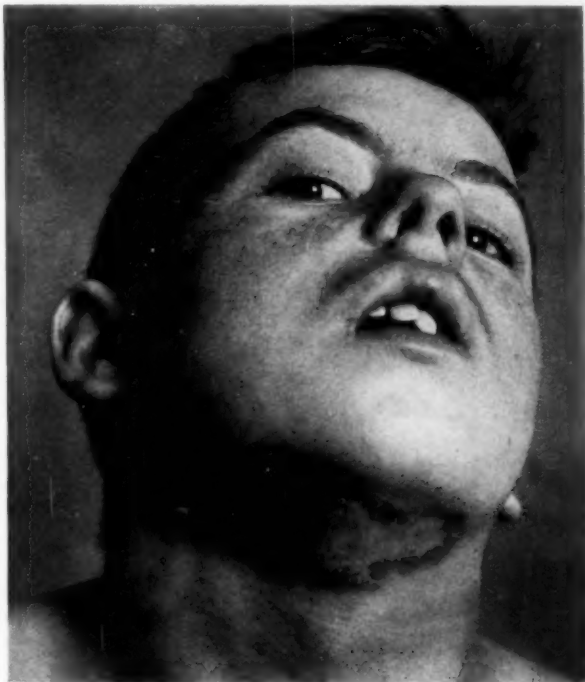


FIG. 7.—Lupus vulgaris; ten years duration.

attaches to each of these. To the first because the conjunctiva over inner aspect of eye was involved and, but for the delicacy with which endothermy was employed, patient's eyesight might have been impaired or destroyed. To the second because here endothermy proved its applicability to a lesion involving cartilage. Such a growth as this is very difficult to excise with the knife and does not readily react to treatment by radium or X-ray.

Many patients who have had protracted X-ray treatment—and many workers with X-ray and radium—develop a keratosis which may become epitheliomatous. These cases often prove most obstinate in handling, and it is

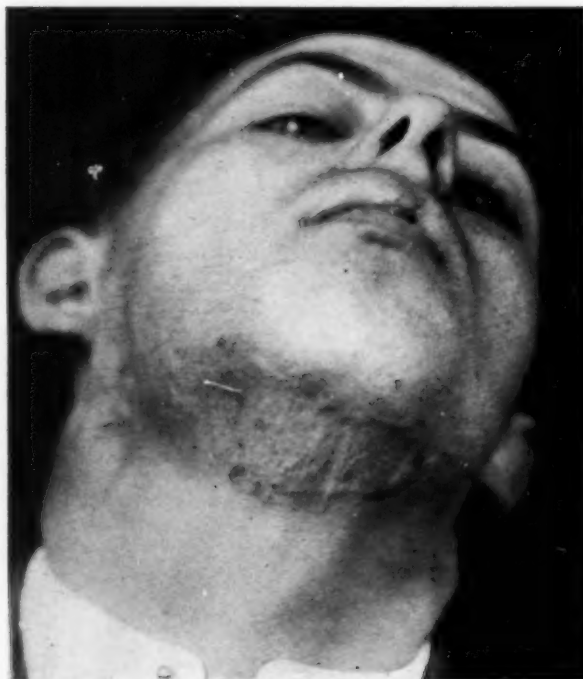


FIG. 8.—Same patient as in Fig. 7. Lesion healed after treatment by monopolar endothermy under local anaesthesia.

a pleasure to report, therefore, that a record of these keratoses treated by endothermy shows a very high percentage of apparent cure with splendid cosmetic result.

For the removal of deep-seated malignancy, *bipolar* endothermy is employed, and the use of the more powerful currents in deep penetration make complete anaesthesia advisable. The preferred anaesthetic is ether, but it must, of course, be taken from the room while the current is in actual use.

We secure the intense, penetrating action of this endogenous heat by the use of the D'Arsonval

or bipolar current—a current of low voltage and high amperage. The result is coagulation. Heat is generated by connecting one pole of the machine to a well-wet, indifferent electrode under the patient's buttocks as he lies upon the table. The other pole—the active electrode—is attached to a handle in which is a sharp-pointed darning needle of proper length and suitable shape.

The first step in the technic of endothermy is to describe in the healthy tissue a ring of destruction necrosis around the malignant area. That is, before the malignancy is touched it is completely surrounded by a wall of coagulation necrosis which isolates the growth and shuts off the blood-vessels and lymphatics to and from the affected part. A specimen for section can now be taken with impunity, after which the malignant area is destroyed *in situ*.

ENDOTHERMY IN NEOPLASTIC DISEASES



FIG. 9.—Epidermoid carcinoma of lower lip two and one-half months duration. Age seventy-six years.

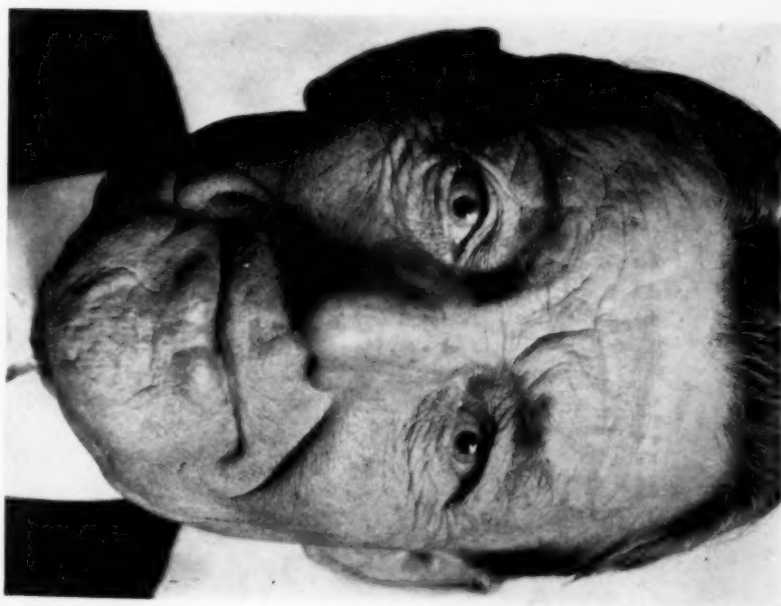


FIG. 10.—Same after removal of carcinoma, following its destruction by monopolar endothermy. Note how completely nature will restore a lower lip.

The operator must learn just how much or how little current shall be used and for how long, bearing in mind always the wisdom of overtreating rather than under-treating. This same wall of necrosis drawn in healthy tissue to shut off blood-vessels and lymphatics cuts off also the sensory nerves. This brings about that prompt alleviation of pain which is one of the remarkable features of treatment by endothermy. How important is this result in that large group of so-called inoperable cancer! Though used in such cases without hope of cure the treatment is highly valuable if it bring relief from suffering. Brief mention must also be made of the grateful effect of the intense

heat upon a foul discharging area, an effect of sterilization and cleansing.

After the lesion has been completely destroyed it is either curetted away, or removed by scissors, as an inert mass. The base is then seared over with the current to assure a further penetration by the heat and to secure a perfectly dry wound. Dosage is always under accurate control of the operator and if the work is properly done there should be no hemorrhage.

Should a bleeding point

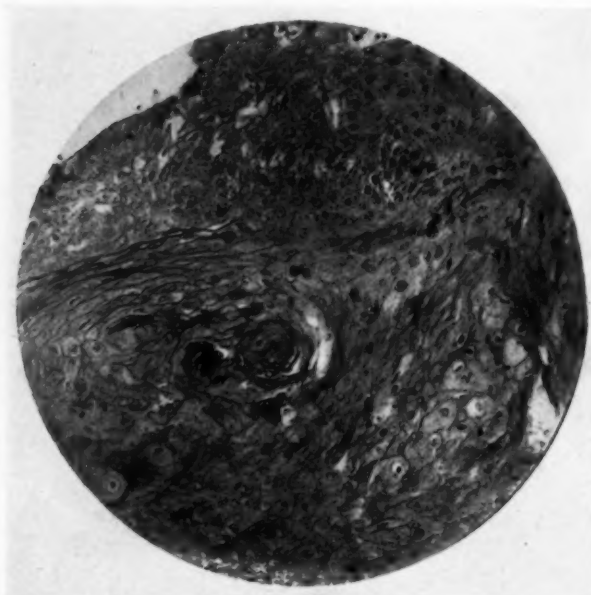


FIG. 11.—Microphotograph of epidermoid carcinoma of lower lip.

be encountered, it is generally controlled by focussing the current on it for a second or two. Secondary hemorrhages rarely occur, but because they have happened in isolated cases, I should take the precaution to do a preliminary ligation were I working in close proximity to a large blood-vessel.

In the squamous-cell variety of epithelioma and the more malignant forms of accessible cancer, particularly in lesions in and about the mouth which metastasize early, are difficult of removal by the knife and are uncertain in their response to physical treatment endothermy is of the very highest value. Endothermy does not act through the induction of any tissue change; endothermy destroys, and this destruction is as effective on the lesion of a squamous-cell epithelioma as on the lesion of the slow-growing basal cell, provided the growth can be surrounded by our ring of protective necrosis, and provided metastasis has not already taken place. Because of the great danger of metastasis in cases of squamous epithelioma no treatment of a lesion of this kind can be considered complete until there has been thorough

ENDOTHERMY IN NEOPLASTIC DISEASES

radiation of the lymphatics draining the affected area. This post-operative—or pre-operative—prophylaxis is never more important than in glandular involvement of the neck which so often complicates lip lesions. The lesion is easily removed in a single treatment under local anæsthesia, but radiation of the glands may need be repeated. In illustration of a case of extensive squamous-cell epithelioma of lower lip is shown Fig. 9. This growth was removed in a single treatment, and the second photograph shows how completely nature will restore the soft lip tissue once the malignancy has been destroyed by endothermy.

By endothermy any portion of a tongue can be coagulated and immediately removed, or it may be amputated without splitting the cheek. A floor-of-the-mouth cancer can be coagulated *in situ* and removed in one operation, making possible that early return to normal diet which is so highly important in these cases since most of these patients are anæmic, cachectic and badly run down. Bony structures, alveolus, hard palate, and portions of the lower jaw can likewise be treated and removed; for this endogenous heat can be made to penetrate bone as well as soft parts.

Furthermore, endothermy's applicability to all lesions of the body surface and of accessible cavities also covers conditions of the hollow viscera, such as the bladder, which can be opened surgically, treated with endothermy and immediately closed. In the treatment of bladder tumors the writer no longer attempts to remove by means of the cystoscope any, except small papillomas where the entire base can be seen. In all other operable cases the invariable rule is to make a hypogastric incision and then—with an electric light in the bladder bringing the lesion into full view—to destroy and remove the tumor at its base after the technic of monopolar endothermy. This offers a far better chance of complete eradication.

When we come to summarize the advantages of endothermy we find that by its quickness and cleanness of application, its accuracy of dosage, its reduction of the dangers of metastasis and the likelihood of recurrence, the rapidity of convalescence and the good cosmetic results it has made for itself in the treatment of accessible neoplastic diseases a place which no other agency can fill.

In conclusion I desire to express my thanks to Prof. John A. Fordyce for his kindness in furnishing me material in his clinic.

ENCAPSULATED ADENOMATA OF THE THYROID

IMPROVED TECHNIC FOR THEIR REMOVAL

By JOSEPH L. DeCOURCY, M.D.

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ADENOMATA are probably the most frequent tumor of the thyroid. In certain localities, they form as high as ninety per cent. of all goiters. We have found this to be true in northern Indiana, following a series

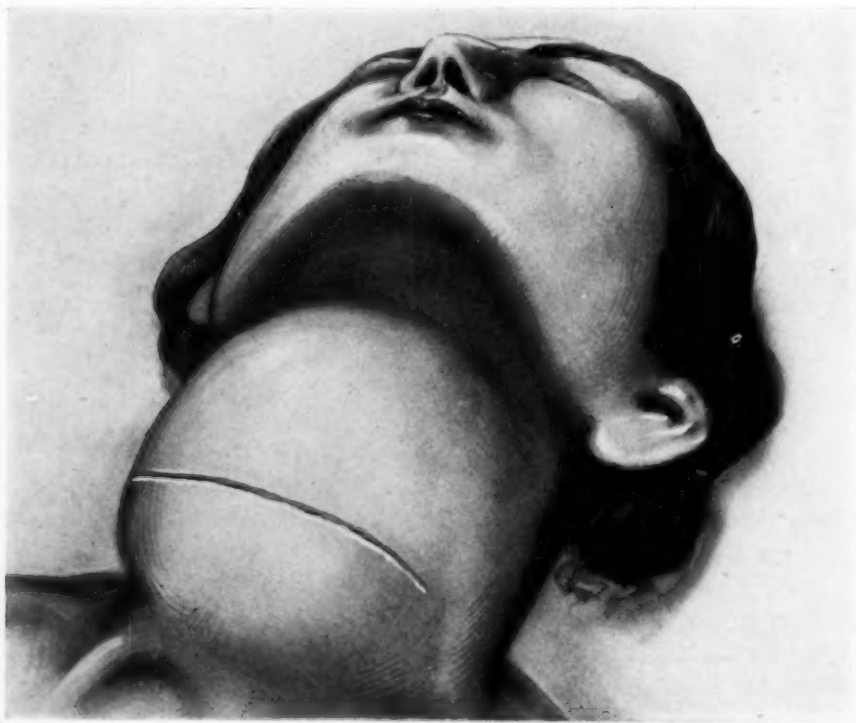


FIG. 1.—Skin incision.

of 750 examinations. In southern Ohio the percentage is lower, varying between forty and fifty per cent. in a series of 3000 examinations.

Their size is variable, occasionally becoming as large as a grapefruit, the majority, however, vary between the size of an egg and a large orange, of either or both lobes.

As an adenoma increases in size, its capsule increases in thickness, seemingly nature's way of preventing disruption. In the smaller variety the

ENCAPSULATED ADENOMATA OF THE THYROID

capsule is usually thin, and therefore of less importance to the surgeon. Adenomata in pushing forward in their growth carry the capsule in front of them, exerting pressure in front and to some extent laterally. For this reason the denser adhesions between the capsule and the tumor itself, occur over the outer half of the growth. We have found this to be especially true when

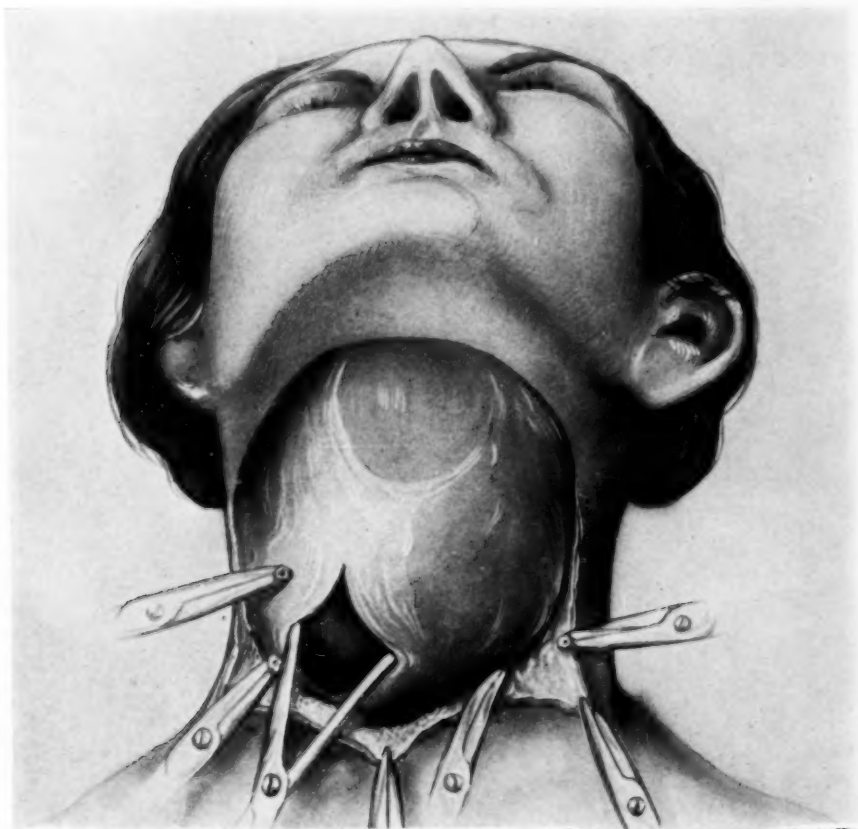


FIG. 2.—Opening of capsule at base of tumor.

operating, and frequently dense adhesions are found overlying the growth when the capsule is opened above, and the operation becomes extremely difficult. This is especially true also when patients have had a series of X-ray exposures, as we so frequently see nowadays.

In order to overcome this difficulty I have devised the technic which is so readily seen from examining the drawings. Instead of opening the capsule at the uppermost portion of the tumor, a small opening is made at the lower portion. The capsule is then separated from the gland and hæmostats placed



FIG. 3.—Division of anatomical capsule between clamps.

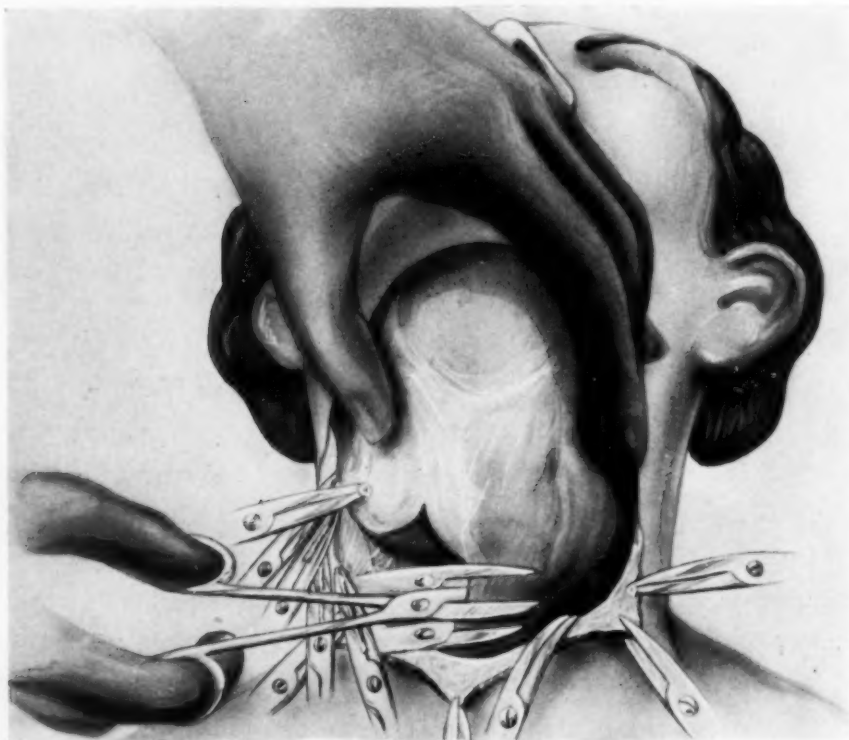


FIG. 4.—Division of capsule continued upward.

ENCAPSULATED ADENOMATA OF THE THYROID

above and below the line of incision. The incision is carried up both sides from below until the adenoma is completely enucleated.



FIG. 5.—Division completed, exposing structures beneath.

The advantages are as follows:

1. Area of adhesion formation is avoided.
2. Hemorrhage is entirely controlled.
3. Capsule does not have to be trimmed away after removal of tumor.
4. Operation can be performed very much more rapidly.
5. There is less trauma.

THE BACTERIOLOGY OF EXTIRPATED TONSILS AND ITS RELATION TO EPIDEMIC TONSILLITIS*

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FELLOW IN SURGERY, THE MAYO FOUNDATION

SINCE the theory of focal infection became an established fact through the work of Billings and his co-workers, the tonsil has been considered an important point of entrance for microorganisms. The microbes, especially the streptococci, attack the organs in two ways; through the circulation, causing various diseases, and through the respiratory tract causing pneumonia and other diseases of the respiratory organs. Cumming, Spruit, and Aten have demonstrated that the throats of 35 per cent. of patients with measles, and of 94 per cent. of patients who develop bronchopneumonia with measles, harbor hæmolytic streptococci. According to Tongs, the number of streptococci in the throats of persons who have had tonsillectomy is far smaller than in those whose tonsils have not been removed. Lillie and Lyons have found notable improvement in 79 per cent. of patients with arthritis, after tonsillectomy alone. Benjamin and Quirk have reported beneficial results after tonsillectomy in an interesting case of orchitis that followed follicular tonsillitis. Schmitz, Davis, Lent and Lyon, Nichols and Bryan, and Pilot and Davis have studied the bacteriology of the crypts of tonsils. All found that the *streptococcus hæmolyticus* was the predominating organism. Davis states that the crypts are covered with a spongy layer of large epithelial cells through which microorganisms can readily pass. Wood has demonstrated that *bacillus anthracis* passes through the lining of the crypts into the parenchyma of the tonsils of pigs, resulting in necrosis of the tissues and invasion of the circulation through the dilated inflamed capillaries, and that invasion does not occur through the mucous membrane of the mouth.

Owing to the marked seasonal variation in the incidence of tonsillitis and other infections of the upper respiratory tract, Doctor Rosenow suggested that I study carefully the bacteriology of extirpated tonsils over a long period, in order to determine the incidence and number of the various types of streptococci and other bacteria in the tonsillar tissue.

Through the coöperation of the staff of the Section on Otolaryngology, of the Mayo Clinic, I have studied the bacteriology of 2048 tonsils removed from July 1, 1922, to June 30, 1923. The tonsils were removed on account of recurring attacks of tonsillitis or, more often, because they were believed to be foci of infection in patients suffering from ulcer of the stomach, chronic infectious arthritis, myositis, cholecystitis, nephritis, and so forth. One tonsil from each patient was placed immediately in 10 per cent. formalin; the other was sent to the laboratory for cultures.

* Work done in the Division of Experimental Bacteriology.

BACTERIOLOGY OF EXTIRPATED TONSILS

TECHNIC

The tonsils were examined grossly to determine thickness of capsule, consistency, and evidence of infection in the crypts, in from one to four hours after enucleation. They were then washed several times in sodium chlorid solution, placed in sterile petri dishes with the crypts down, and about twenty drops of 70 per cent. alcohol were sprinkled on the surface, after which they were again washed in sodium chlorid solution. Sterile scissors with sharp points were stabbed through the capsule into points of fluctuation, avoiding the crypts, and the scissors were then opened, making a large hole through the capsule. Cultures from the pus which usually exuded, or from the material which was pressed out with sterile forceps, were made routinely on the surface of blood-agar plates and in tall tubes of glucose-brain-broth. These were incubated at 36.5° C. for from eighteen to twenty-four hours, when the character of the growth was noted. In the case of the blood-agar-plate cultures, the number of colonies of the various types of streptococci was determined, together with other organisms. In many instances, anaërobic cultures on blood-agar slants were also made.

GROSS AND MICROSCOPIC FINDINGS

The size and consistency of the tonsils varied greatly. In many instances, pus was expressed from the crypts, and on section one or more abscesses were found near the capsule, even though the patient had not had symptoms referable to the tonsils, and when examination *in situ* was largely negative. The pus was greenish-yellow and usually showed large numbers of organisms in smears. The material pressed out of the crypts often contained small particles resembling the granules of actinomycosis, but which on microscopic examination were found to consist of large numbers of microorganisms and necrotic desquamated cells. In a relatively small number of the tonsils, usually from children, the chief change was hypertrophy; abscesses were rarely found in these, but thin pus often was expressed which revealed large numbers of streptococci and other bacteria in smears.

RESULTS OF GLUCOSE-BRAIN-BROTH CULTURE

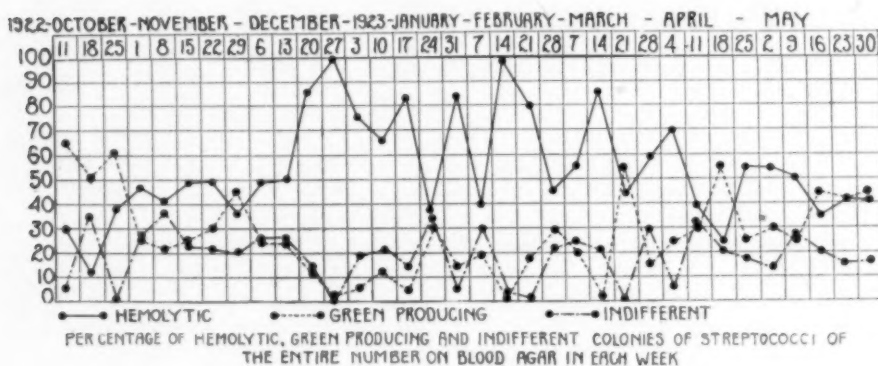
In the glucose-brain-broth cultures the streptococci predominated. Sometimes a small number of staphylococci and Gram-negative bacilli were also found. Growth nearly always began at the bottom of the tube within eight to nine hours, and it had nearly always grown to the top in from eighteen to twenty-four hours. In most instances the growth was granular, with deposits along the sides of the tube and early precipitation, although occasionally diffuse turbidity was produced. When the growth was granular, long chains and clumps of streptococci varying in size and in reaction to Gram stain were found, whereas in those that showed diffuse turbidity, diplococci and short chains of more uniform size were found, all of which were Gram-positive. In smears from the bottom of the tubes, especially in those with marked involution forms and which were incubated for more than twenty-four hours, variations in staining reaction were noted. Certain organisms were very large, and others extremely small, even in the same chain, the former usually being Gram-positive, the latter Gram-negative. Frequently blood-agar plates of the cultures in glucose-brain-broth yielded a predominating number of green or indifferent colonies of streptococci, and relatively few or no hæmolytic streptococci, even when the primary plating revealed many hæmolytic and few indifferent colonies.

RESULTS OF BLOOD-AGAR-PLATE CULTURES

The streptococci were classified into three main types: (1) the hæmolytic streptococcus, with a small, usually dry, granular colony, sometimes elevated,

sometimes flat and spreading, and surrounded by a wide zone of complete hæmolysis; (2) the green-producing streptococcus, which produced usually small, grayish, somewhat dry, elevated colonies, more rarely flat, moist, slightly spreading colonies, which usually revealed a greenish tinge on transmitted light, and were surrounded by a narrow zone of partial hæmolysis; and (3) the indifferent streptococcus which produced small, dry, grayish colonies that had no effect on the medium. The number and proportion of the types varied greatly. A careful record of the number of each type of colony on blood-agar plates was made from October 11, 1922 to May 30, 1923; they varied from one to countless numbers. This includes the results obtained from 1,250 tonsils from as many patients. Fifty-two per cent. of the entire number revealed hæmolytic, 58 per cent. green-producing, and 18 per cent., indifferent streptococci, alone, or with other types.

The average number of colonies of the types of streptococci that developed on the blood-agar plates by weeks was determined. In instances in which they



were innumerable, the arbitrary figure of 3000 was used for the calculation. The percentage of the types of streptococci compared with the total number obtained on blood-agar plates is given in the chart. The percentage of the different streptococci was similar during the period of observation, but varied according to the change in the seasons. Thus, during three weeks in October, the green-producing colonies predominated. The curve is depressed until the latter part of May, when it rises; whereas the curve representing the percentage of hæmolytic streptococci is low during October, rises to a relatively slight predominating level during November and the early part of December, and then to a still higher level, where it remains until the early part of April, when it drops to a low level. The curve representing the indifferent type of streptococci was usually the lowest throughout the time of observation. The total incidence of the isolation of the types of streptococci in general agreed with the percentage incidence, and varied considerably from week to week and according to season. Eighty-four tonsils yielded the streptococci in pure culture, fifty-one of which were hæmolytic, twenty-seven green-producing, and six indifferent. The thermal death point of 115 strains of the streptococci isolated was tested. It was found that fifteen minutes at from 56° to 60° C. sufficed to kill in every instance.

VIRULENCE OF THE STRAIN

The virulence of the types of streptococci was of a relatively low order. Of six mice injected intraperitoneally with 2 c.c. of the primary culture in glucose-brain-broth, five died; of twenty-eight injected with 1.5 c.c., five died; of twelve injected with 0.75 c.c., three died; of four injected with 1 c.c. one died, and of

BACTERIOLOGY OF EXTIRPATED TONSILS

five injected with 0.5 c.c., one died, all from peritonitis. The rabbits injected with from 5 to 6.5 c.c. of the primary culture usually survived, but on examination lesions were found in a high percentage in organs corresponding to those affected in the patient from whom the tonsils had been removed. The detailed results of the animal experiments will be reported elsewhere.

In 841 tonsils, microorganisms other than streptococci were studied also. Staphylococci were frequently found in large numbers and usually were hæmolytic; *Micrococcus catarrhalis* was found in 570 (68 per cent.); the number of colonies varied greatly, but was usually large. *Staphylococcus albus* was found in 254 (30 per cent.); *staphylococcus aureus* in seventy-two; *staphylococcus citreus* in six; colonies resembling *bacillus influenzae* were found surrounding streptococcus or staphylococcus colonies in seventy-five; *bacillus diphtheriae* was found in thirty; *bacillus coli* in forty; *bacillus Friedländer* was found in large numbers in twenty-three, and *micrococcus tetrigenus* was found in eighteen. The pneumococcus was not usually differentiated from the green-producing colonies of streptococci, but in some instances fermentation of inulin was determined. Search for acid-fast bacilli was made in smears of the pus or other material obtained from the tonsils in about 100 cases, but the bacilli were not found in a single instance.

FERMENTATIVE POWER OF THE STREPTOCOCCI

All of the fifty strains of hæmolytic streptococci from the tonsils of fifty patients fermented glucose, thirty-four fermented saccharose, thirty-three lactose, sixteen raffinose, eleven inulin, sixteen salicin, and eight mannite. Thirty-five produced acid in milk, twenty-seven of these also causing coagulation. All of the fifty-four strains of green-producing streptococci from the tonsils of fifty-four other patients fermented glucose, forty-seven fermented saccharose, fifty-one lactose, thirty-six raffinose, twenty-two inulin, twenty-four salicin and eight mannite. Forty-seven produced acid in milk, thirty-seven of which also caused coagulation.

DISCUSSION AND CONCLUSIONS

A point of particular interest regarding the results of the cultures is the relative increase in the number of hæmolytic streptococci which occurred in December and lasted throughout the winter months. At about the time when the hæmolytic streptococci became predominant, an epidemic of tonsillitis and sore throat developed in Rochester, continuing until about the middle of April, when the relative number of hæmolytic streptococci became noticeably less. The patients from whom the tonsils were removed had no acute inflammation of the tonsils at the time of tonsillectomy, nor was there a history of attack shortly before. In view of the fact that most of these patients came from widely separated regions, there is reason to believe that the increase in hæmolytic streptococci during the winter months occurs generally, and that the increased incidence of hæmolytic streptococcus tonsillitis is due more to climatic conditions than to contact infection. It is well known that accidental infections incident to surgical operations, usually due to hæmolytic streptococci, are more prone to occur during epidemics of infections of the upper respiratory tract. This study demonstrates that the number of hæmolytic streptococci in the tonsils of persons without history of actual infection becomes unusually large during the winter months when tonsillar infections are prevalent, and it warrants the suggestion that extraordinary care be taken to prevent con-

tamination of instruments, the field of operation, and so forth, from the mouths of the personnel of the hospital operating rooms.

From my study, it may be concluded that streptococci occur more commonly and in larger numbers than other bacteria in the parenchyma of extirpated tonsils. The incidence and relative number of hæmolytic streptococci increase with the coming of cold weather and the prevalence of tonsillitis and allied conditions.

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A STUDY ON FOCAL INFECTION AND ELECTIVE
LOCALIZATION IN ULCER OF THE STOMACH
AND IN ARTHRITIS*

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IT is well known that a small number of certain microorganisms of low virulence may circulate in the human body and not cause symptoms, but if they lodge and multiply in organs, or become virulent, symptoms develop, as in staphylococcal osteomyelitis or gonorrhœal gonitis. Various facts indicate that bacteria rarely enter the blood stream through the normal skin and mucous membrane, but that entrance is prone to occur when these tissues become the seat of lesions, traumatic or inflammatory, and that when tissues, such as the tonsils, for mechanical reasons, harbor large numbers of microorganisms, invasion probably occurs at frequent intervals. The bacteria may establish colonies in certain organs, produce secondary foci, and thus overcome the resistance of the host, so that systemic disease results. Such processes are generally defined as "focal infection."

Billings^{1, 2, 3, 4} has emphasized the importance of focal infection in arthritis, nephritis, and endocarditis. Davis made a special study of the microorganisms in tonsils excised for a variety of clinical conditions, including chronic arthritis, nephritis, endocarditis, recurring tonsillitis, and neuritis. Rosenow^{12, 13, 14, 16, 17} produced lesions in the stomach, duodenum, appendix, gall-bladder, iris, skin, joints, muscles, nervous system, endocardium, and kidney of rabbits by injecting streptococci or pneumococci from infected tonsils and teeth of patients who were or had been suffering from the corresponding diseases.

Many patients with ulcer of the stomach, arthritis, or other diseases believed to be focal in origin, improve or recover after complete removal of foci. Lillie and Lyons, in a study of 200 cases of myositis and arthritis, found that 79 per cent. of the patients improved markedly after tonsillectomy. The organs in which the primary foci are usually found are tonsils, teeth, sinuses, gall-bladder, intestines, appendix, cervix, seminal vesicles and prostate.

Certain microorganisms tend to invade certain tissues. The gonococcus attacks large joints and tendon sheaths, and the meningococcus invades the meninges. In acute multiple suppurative myositis, staphylococci attack the skeletal muscles with a narrow specific affinity.¹¹ Jackson^{7, 8} produced

* Work done in the Department of Experimental Bacteriology.

arthritis and myocarditis in rabbits by the injection of a streptococcus isolated from epidemic sore throat, which disease was frequently accompanied by myocardial and joint infections. Irons, Brown and Nadler produced iritis by the injection of streptococci from cases of iridocyclitis. Rosenow¹⁵ found that iritis and other ocular lesions developed following intravenous injection of streptococci only when they were of a particular grade of virulence.

Certain species of bacteria, especially the streptococcus, attack many organs, and when injected into animals may localize in joints, in the mucous membrane of the stomach or duodenum, in muscles, heart, kidney, central and peripheral nervous systems, gall-bladder, and so forth. But not all of these organs are attacked by the same strain. Rosenow^{13, 14, 16} found that bacteria, especially the streptococci taken from original or secondary foci of patients suffering from ulcer of the stomach, arthritis, appendicitis, and so forth, have specific affinity for the stomach, the joints, the appendix, and so forth, respectively, and on the basis of these findings he has propounded the theory of elective localization.

I have studied the bacteriology of extirpated tonsils and the localizing power of the bacteria isolated in a series of selected cases of arthritis and ulcer of the stomach observed in the Mayo Clinic from July 1, 1922, to June 30, 1923, and I shall report here the results of animal experiments in cases of ulcer of the stomach and of arthritis, and in control cases. The results of the cultures will be reported elsewhere.

TECHNIC OF EXPERIMENTS

The extirpated tonsils were washed in sterile sodium chlorid solution, and material for culture was obtained from the pus or from the material pressed out with sterile forceps after puncturing the capsule with sterile scissors. This was plated on blood-agar and inoculated into tall tubes of glucose-brain-broth. In most cases the glucose-brain-broth culture yielded streptococci alone, sometimes also staphylococci, *Micrococcus catarrhalis*, or other bacteria. As a routine, the eighteen-hour culture, incubated at from 35° to 36.5° C., was used for injection in a 5 c.c. dose for medium size or full-grown rabbits; the injection was made in the marginal vein of the ear, each animal receiving one injection. The culture was inverted just before injection for the purpose of mixing the bacteria, because the localizing nature of those at the top and those at the bottom might not be the same. The culture on blood-agar plate was not used, because long exposure to oxygen destroys the localizing property of the streptococcus.¹⁴ From forty-eight to seventy-two hours after injection, the animals were chloroformed and examined closely for changes in the eyes, endocardium, myocardium, pericardium, lungs, liver, gall-bladder, bile, stomach, duodenum, appendix, intestines, spleen, kidneys, urinary bladder, muscles of the trunk and extremities, knee, shoulder and elbow joints, and the bone-marrow of the tibia. Cultures were made from each organ and from the blood. When an ulcer or hemorrhage was found in the stomach, the infected area was cut out and placed in 10 per cent. formalin, or washed with sterile sodium chlorid solution and emulsified in a sterile manner, then inoculated into the culture mediums, glucose-brain-broth and blood-agar.

FOCAL INFECTION IN ULCER OF THE STOMACH

Sometimes the pus from the tonsil was suspended in sodium chlorid solution and injected into rabbits, usually in doses of from 2 to 5 c.c.

The cases for animal experiments were carefully selected. Only those were studied in which the tonsils were septic and in which active symptoms of ulcer of the stomach had developed a short time before, or chronic cases in which recent exacerbation of symptoms had developed.

ILLUSTRATIVE CASES (ULCER OF THE STOMACH)

CASE IV.—A man, aged forty years, came to the Clinic November 11, 1922, on account of stomach trouble which he had had for twenty-five years. The symptoms, which recurred at intervals of from three to four months, consisted of indigestion, gas, dull pain occurring about an hour after meals, nausea, vomiting, belching, and occasionally hæmoptysis and tarry stools. In January, 1921, a diagnosis of duodenal ulcer had been made, and the teeth were found to be septic. In June, the patient came to the Clinic, posterior gastro-enterostomy and appendectomy were performed, and a special diet was prescribed. The gastric symptoms disappeared until the latter part of October, 1922. Röntgenograms revealed an ulcer along the lesser curvature of the stomach. December 7, five infected teeth, and January 9, 1923, four teeth were removed. February 3, tonsillectomy was performed. By February 12, the symptoms referable to the stomach had disappeared, and röntgenograms of the stomach were negative. July 10, the patient still felt well but returned for examination. He had gained 20 pounds, and röntgenograms of the stomach were negative.

Hemorrhage or ulcer, or both, of the stomach were found, with no lesions elsewhere, in the two rabbits injected with pus from the tonsil, in the two injected with the primary culture in glucose-brain-broth, and in the two injected with the sodium chlorid solution washings of the apices of two infected teeth. Four controls, two injected with sodium chlorid solution, and two with sterile glucose-brain-broth, did not have lesions. The four injected with the primary culture in glucose-brain-broth from the teeth revealed multiple hemorrhages and ulcer of the stomach; one also had a vegetation on the tricuspid valve, one, hemorrhages in the muscles of the leg and abdominal wall, and one, turbid fluid in the knee joints. The two injected with the second culture of one of the teeth remained free from lesions, whereas the two injected with the third subcultures had slight lesions of the stomach.

Four rabbits were injected with the strain from one of the teeth in the primary culture and second animal passage, two receiving 5 c.c. of the glucose-brain-broth culture, and two 0.2 c.c. diluted with 5 c.c. of sodium chlorid solution. The first two died; they had marked lesions of the stomach; one also had hemorrhages in the abdominal muscles. The other two appeared well the day after injection; one had three hemorrhagic ulcers in the stomach; no lesions were found in the other. Two that received the same strain in the second subculture had lesions of the stomach. Three that were given the cleared glucose-brain-broth of the third subculture were free from lesions. Two rabbits receiving the strain in the third animal passage had hemorrhage of the stomach; one also had an ulcer and hemorrhage in the tricuspid valve. The two injected with the strain in the fourth animal passage were found dead on the third day, both with hemorrhage and ulcer of the stomach; one also had hemorrhagic oedema over the base of the lungs, and the other, numerous hemorrhages of the appendix.

TABLE I.
Results of Experiments with Nine Strains from Patients with Gastric Ulcer or Hemorrhage.

Case	Age (years)	Sex	Duration of symptoms	Severity of attack	Date of last attack	Date of tonsillectomy	Character of streptococcus	Animal experiments		
								Number injected	Positive	Negative
1	39	F	16 years	Marked (hemorrhage)	June, 1922	June 27, 1922	Viridans	2	2	0
2	47	M	15 months	Moderate	Nov., 1922	Jan. 2, 1923	Viridans	5	3	2
3	21	M	3 years	Moderate	Jan., 1923	Jan. 9, 1923	Viridans	6	3	3
4	40	M	25 years	Moderate	Jan., 1923	Jan. 9, 1923, (teeth removed) Feb. 3, 1923	Viridans (teeth and tonsils)	29	24	5
5	40	M	17 months	Marked (hemorrhage)	Jan., 1923	Jan. 29, 1923	Viridans	9	6	3
6	39	M	5 years	Slight	Jan., 1923	Feb. 1, 1923	Viridans	4	2	2
7	32	M	8 months	Moderate	Feb., 1923	Mar. 21, 1923	Viridans	2	0	2
8	48	F	8 years	Moderate (hemorrhage)	Apr., 1923	June 11, 1923	Hæmolytic	5	3	2
9	33	M	15 months	Marked (hemorrhage)	May, 1923	July 16, 1923	Hæmolytic	4	3	1
Total.....								66	46 (70%)	20 (30%)

FOCAL INFECTION IN ULCER OF THE STOMACH

One of three rabbits injected with an emulsion of the tonsils in sodium chlorid solution developed hemorrhage and ulcer of the stomach; the other two did not have lesions. The two injected with the primary culture from the extirpated tonsils had marked lesions of the stomach, and one also had embolic lesions in the kidneys, and turbid joint fluid.

Comment.—The points of particular importance in this case are the temporary effectiveness of gastro-enterostomy in the face of focal infections, the disappearance of gastric symptoms, and the röntgenograms negative within one month after the removal of foci containing streptococci with elective affinity for the mucous membrane of the stomach.

CASE IX.—A man, aged thirty-three years, came to the Clinic in May, 1923, on account of recurring attacks of stomach trouble, associated with tarry stools. Röntgenograms of the stomach and intestines were negative. A diagnosis of obscure gastro-intestinal hemorrhage was made. The patient's tonsils were septic. June 25, an exploratory laparotomy revealed chronic appendicitis, and the appendix was removed. July 16, tonsillectomy was performed. About two weeks later the patient appeared to be well. The cure was attributed to the tonsillectomy.

Cultures of the extirpated tonsils yielded hæmolytic streptococci. Three cubic centimetres of a sodium chlorid solution suspension of the pus from the tonsils was injected into two rabbits. At necropsy, a hemorrhagic area was found on the lesser curvature of the stomach of one rabbit; the other was free from lesions. The glucose-brain-broth culture of the pus from the tonsil was injected into two other rabbits. Necropsy disclosed hemorrhages in the mucous membrane near the cardiac end of the stomach of one rabbit. In the other rabbit were found two bleeding ulcers on the lesser curvature of the stomach, turbidity of the fluid around the left knee joint, an abscess in the right kidney, and many punctate hemorrhages in the lungs.

Comment.—The points of special interest in this case are the cessation of gastric symptoms after tonsillectomy, and the production of hemorrhagic lesions of the stomach in the rabbits.

SUMMARY OF RESULTS IN THE ULCER EXPERIMENTS

Of the nine patients with gastric symptoms selected for animal tests, five had undoubted ulcer findings and four had severe hemorrhages, presumably due to acute ulcers. The main clinical facts in the cases, and the incidence of lesions in the stomach of rabbits injected are summarized in Table I. Seven of the patients were men, and two women. The ages ranged from twenty-one to forty-eight years. The duration of symptoms was from eight months to sixteen years. Exacerbation of symptoms occurred at about the time of, or within three months prior to, tonsillectomy. Gross evidence of infection of tonsils was found in all. *Streptococcus viridans* predominated in the cultures injected in seven, and slightly hæmolyzing streptococcus in two of the cases. Elective localization occurred in all but one of the former and in both of the latter.

Strains from nine patients with ulcer of the stomach were studied experimentally. Seventy-three rabbits were used, seven of which were controls. Of the sixty-six rabbits injected with the strains from tonsils, forty-six (70 per cent.) had hemorrhage or ulcer, or both, in the mucous membrane of the

stomach (Table II). Only one of the nine strains gave negative results on animal injection. Lesions occurred in the pylorus in twenty (43 per cent.) of the positive rabbits, along the lesser curvature in eighteen (40 per cent.),

TABLE II.
Incidence of Lesions in Various Organs.

Source of streptococci	Number of strains	Number of animals injected	Stomach or duodenum Per cent.	Joints Per cent.	Muscles Per cent.	Heart Per cent.	Kidney Per cent.	Lungs Per cent.
Gastro-duodenal ulcer.	9	66	70	30	2	6	4.5	8
Arthritis.	49	97	29	85	9.2	12	10	1
Normal control. . .	55	102	25.5	24.5	12.5	9.5	9.5	2

along the greater curvature in ten, and in the fundus in thirteen. This incidence corresponds in general to the occurrence of ulcer in these regions in man. A streptococcus similar to that found in the pus from patients' tonsils and in extirpated tonsils was isolated from both the hemorrhagic and the

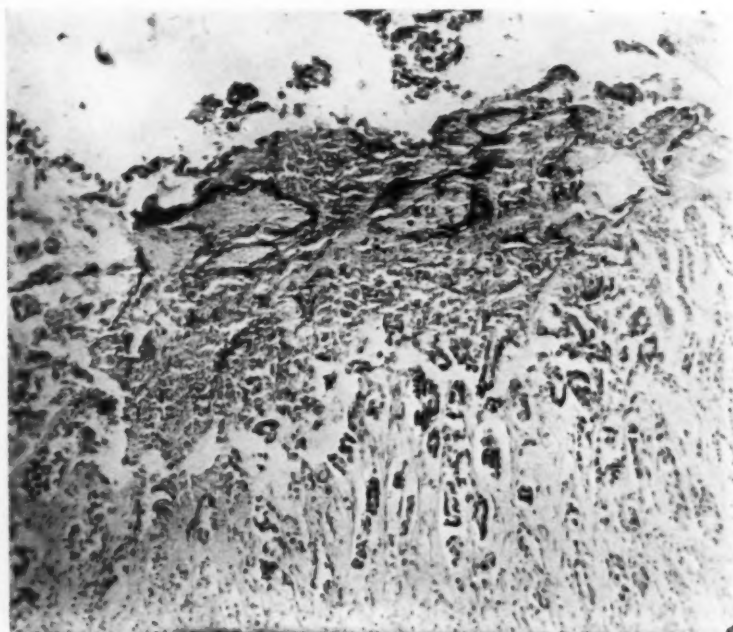


FIG. 1.—Section of hemorrhagic ulcer of the stomach in rabbit forty-eight hours after intravenous injection of the streptococcus from ulcer. Hematoxylin and eosin (X 60).

ulcerated areas in the stomach of the rabbits. In three of the animals, staphylococci and *Micrococcus tetragenus* also were found. Cultures from excised areas of adjacent normal mucous membrane, if thoroughly washed, were generally free from streptococci, and only occasionally showed *Bacillus coli* and *Bacillus subtilis*.

FOCAL INFECTION IN ULCER OF THE STOMACH

Besides lesions of the stomach, hemorrhages and vegetation on the right tricuspid valve in four rabbits, hemorrhages in the lungs in five, turbid joint fluid in nineteen, from ten of which the streptococcus was isolated, hemorrhagic lesions of the kidneys in three, and hemorrhage in the skeletal muscles of one were noted. The ulcers were about 0.25 cm. wide, and varied from 0.25 to 0.5 cm. in length. They were usually superficial and covered with blood. The small ones occurred in groups of from three to five, and when the blood clot was rubbed off only slight gross defects in the epithelium could be detected, or none at all. In the larger ones, which were usually situated on the lesser curvature near the pyloric ring, the ulceration was found to be marked after the blood clot was removed.

The microscopic changes in the lesions consisted mainly of a variable degree of sharply localized interstitial infiltration by erythrocytes, leucocytes, eosinophils, and round cells, which often extended two-thirds of the length of the tubule, rarely to the muscularis mucosæ. In the areas in which the lesions had progressed to ulceration, disintegration of gland cells and an accumulation of leucocytes within dilated vessels in the submucosa, surrounded by a zone of greatly dilated capillaries, poorly-staining nuclei in the tubule cells, and granular cytoplasm were almost constantly found (Fig. 1). Sections stained by Gram's method revealed large numbers of diplococci in the deep layers of the blood clots and in the infiltrated desquamating tissue (Fig. 2), and fewer of the organism in the deep layers of marked cellular infiltration; there were no bacteria in the normal tissues.

The incidence of non-specific lesions of the ulcer and arthritis strains was about the same as that of the control strains. It paralleled closely that obtained by Rosenow and may be regarded as a measure of the relative susceptibility of various organs to bacterial invasion, since it corresponds roughly to the incidence of spontaneous infections in these organs, and of the potential invasive power of bacteria in foci of infection. The element of specificity in the ulcer and arthritis strains may thus be expressed by the difference between the total incidence and the incidence of non-specific strains, or 34 per cent. for the stomach strains and 61 per cent. for the joint strains, respectively.

The exceptionally large number of punctate hemorrhages in the mucous membrane of the stomach in the animals injected with the strains from the patients with recurring gastric hemorrhage without demonstrable ulcer, and the prompt disappearance of the patient's attacks following removal of the

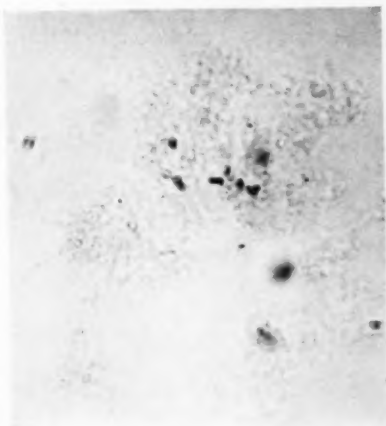


FIG. 2.—Diplococci in the deep layer of the infiltrated sloughing tissue shown in Fig. 1. Gram (X 1000).

tonsils, indicate that focal infection and elective localization may be a common cause of this somewhat obscure condition.

The results in the animals and the prompt recovery of the patient in Case IV after removal of foci, support the view that foci of infection are often responsible for recurring ulcer, and that the possibility of infection may play an important part in the causation of ulcer along the line of closure following gastro-enterostomy, which is now generally believed to be due to suture material.¹⁰

ILLUSTRATIVE CASES OF ARTHRITIS

CASE I.—The patient, a man, aged thirty-six years, complained chiefly of backache which had persisted at irregular intervals for three years. Röntgenograms revealed hypertrophic arthritis of the lumbar spine. The tonsils and several teeth were infected. Tonsillectomy was performed, and the green-producing streptococcus was isolated from the extirpated tonsils.

Two rabbits were injected with the culture in the second, third and fourth animal passages. In general the findings were similar, consisting of increased fluid around the elbow, shoulder, and knee joints, and a variable degree of turbidity of the joint fluid. In three of the rabbits, punctate hemorrhages were found in the stomach, and in one, small abscesses in the kidneys. *Streptococcus viridans* was isolated from the turbid joint fluid.

CASE II.—A woman, aged forty-five years, had had a pain in her shoulder for several years, which had been relieved by tonsillectomy for one year, when it recurred. She also had had pain in her feet and ankles. About seven years later, gall-bladder symptoms developed, and cholecystectomy and appendectomy were performed. The patient grew worse, and biliary drainage was instituted, affording temporary relief from the symptoms. Colon bacilli, staphylococci, and streptococci were recovered from the bile. A diagnosis of infectious arthritis was made. A moderate number of *Streptococcus viridans* and a few staphylococci were recovered from the bile after biliary drainage.

The culture of the streptococcus was injected into five rabbits. All of the rabbits developed lesions of the joints, and turbid fluid was found in the knee joints of four, and in the shoulder and elbow joints each of two. Periarticular hemorrhages, hemorrhages of abdominal and psoas muscles, hemorrhagic ulcer of the mucous membrane of the stomach, and thickening of the wall of the gall-bladder were each found in two rabbits; one also had endocarditis. A moderate number of streptococci were found in the joints of two of the rabbits, and in the hemorrhages of the muscles, in the bile, and in the thickened part of the gall-bladder of two.

A vaccine was prepared from the streptococcus which was recovered from the bile and the knee joint of one of the rabbits. After the second injection of vaccine, the patient was able to walk without a cane. At the end of one month, she was much better and could walk and move her arms almost normally. Three months later she had almost entirely recovered.

CASE III.—A woman, aged fifty-four years, had had frequent, recurring pain in both knee joints for about eleven years. The pain finally became almost continuous. A diagnosis was made of hypertrophic arthritis and septic tonsils. The tonsils were removed, and hæmolytic streptococci were recovered from them in predominating numbers.

Four rabbits were injected. All of them had turbid fluid in the knee joints, two in the shoulder joints, and two in the elbow joints. Slightly hæmolyzing streptococci were isolated from the affected joints. Besides the articular lesions,

FOCAL INFECTION IN ULCER OF THE STOMACH

vegetation of the heart valve was found in two, and hemorrhage of the mucous membrane of the stomach in two.

CASE IV.—A man, aged forty-eight years, had had pain in his left shoulder for several months. The trouble gradually involved all joints; the knee and the ankle joints, which swelled occasionally, caused the most pain. Infectious arthritis was diagnosed. Tonsillectomy was performed, and the culture from the tonsils yielded long-chained, green-producing streptococci.

Six rabbits were injected, four of which developed articular lesions. Turbid fluid was found in the knee joints and shoulder joints of three, and in the elbow joints of two. Two rabbits had periarticular hemorrhages, four had hemorrhages in the mucous membrane of the stomach, and one had a hemorrhage in the appendix. *Streptococcus viridans* was isolated from the turbid fluid in the joints of three rabbits, and from the periarticular hemorrhage of one.

SUMMARY OF ARTHRITIS EXPERIMENTS

The ages of the patients with arthritis and rheumatism ranged from thirty to sixty years. The symptoms, usually aggravated by changes in weather, varied in duration from three months to ten years. The knee, shoulder, and wrist joints were most often involved, the small joints and the lumbar spine less often. History of recurring attacks of tonsillitis was rare. The extirpated tonsils revealed evidences of moderate or severe infection; some contained abscesses, and all had a thickened fibrous capsule.

Many of the rabbits remained quiet for a short time after injection, but afterward appeared well, moved about, and ate normally. In these, only slight lesions of the joints, and moderately turbid joint fluid were found. Others sat humped up and were disinclined to move. Hopping appeared painful, and they spared the extremities, in which, after death, marked lesions of the joints were found. If death occurred from the streptococci, it was usually on the second or third day, never later than the fourth.

The joints attacked showed swelling of the periarticular tissues, such as ligaments, tendons and tendon sheaths, and muscles. The swelling was due chiefly to oedema and often was accompanied by streaks of hemorrhage or congestion of capillaries around the joints. The hemorrhages were mostly found on the anterior aspect of the knee joints. They were linear, and situated parallel to the course of the tendons. When the lesions were not severe, these external articular changes were not manifest, even though the joint fluid was turbid. For the examination of lesions within the joints, the articular ligaments were cut in a sterile manner on the stretched side, at right angles to the longitudinal axis of the bones. The free fluid in the joints, if increased in amount, immediately exuded; sometimes it was hidden in the recesses of the joints, but could be pressed out. In one case the joint capsule of the elbow had become perforated and the pus penetrated between the muscles of the foreleg. Hemorrhages were found only once on the internal aspect of the joint structures. The fluid in the normal joints was clear and not increased in amount, but that in the involved joints was increased, and ranged from slight turbidity to the consistency and turbidity of pus, often containing a good deal of fibrin.

TABLE III.
Results of Agglutination Experiments with Immune Serum, Prepared with One Strain of the *Streptococcus Viridans* from Arthritis.

Case	Diagnosis	Source of streptococcus	Character of streptococcus	Immune serum.					Dilutions:					Normal serum.										Dilutions:					Sodium Chloride solution																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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FOCAL INFECTION IN ULCER OF THE STOMACH

Serum prepared with the same strain after preservation in glycerin for three months.

[illegible]

The majority of the cells in the turbid articular fluid were polymorphonuclear neutrophilic leucocytes; there were relatively few lymphocytes and endothelial cells, and no erythrocytes. Endothelial cells were sometimes found in the clear fluid. Streptococci were never found directly in smears; their existence was proved only by culture.

The articular surfaces of the bones were normal in joints in which the fluid was clear, whereas in the joints in which it was markedly turbid, the cartilaginous surfaces were dull and rough and sometimes covered with a fibrinous layer. The discovery of the bacteria in the fluid was quite irregular; sometimes a clear, relatively scanty fluid produced a good growth in the medium, whereas at other times in a large quantity of fluid, no living bacteria were found. Generally, however, the streptococcus was found more easily and abundantly in the increased turbid fluid. Often when many joints were attacked in one animal, one or two of the joints failed to yield streptococci in the culture medium.

Ninety-seven rabbits were injected in the experiments on arthritis, 85 per cent. of which developed lesions of joints and turbid fluid. In seven rabbits, periarticular hemorrhages were found, and in one each, a hemorrhage in the interior of one joint, and hemorrhage in the lung. Lesions of the heart, consisting of vegetation or hemorrhage on the tricuspid valve, occurred in 12 per cent.; ulcer or hemorrhages in the mucous membrane of the stomach in 28.7 per cent.; hemorrhages or abscesses in the muscles in 9.2 per cent., and hemorrhages or abscesses in the kidneys in 10 per cent. The lesions in the joints were distributed over the knees, the elbows, and the shoulders, and often were found on both sides.

The streptococcus was proved to be present in the joints of fifty-nine (72 per cent.) of the positive rabbits, whereas cultures from the other organs only rarely yielded this organism. The localizing power of the streptococcus was rather well retained through animal passage; in some instances the specificity increased, whereas in others it diminished.

AGGLUTINATION EXPERIMENTS WITH ARTHRITIS STRAINS

Streptococcus viridans from the tonsil of a patient with arthritis, and which was isolated from an infected joint of a rabbit that had been injected intravenously, was grown in large amounts of glucose-broth for eighteen hours, centrifuged, washed in sodium chlorid solution, and preserved in dense suspension in glycerin (two parts) and 25 per cent. sodium chlorid solution (one part).

One series of four rabbits was immunized immediately, another after the strain had been preserved in glycerin for four months (Table III). The vaccine in each case was prepared by diluting the dense suspension with sodium chlorid solution to the density of glucose-broth culture and heating this at 60° C. for thirty minutes. Each rabbit received 9 c.c. of the vaccine over a period of five weeks, receiving increasing doses on three successive days for each week as follows: 0.1, 0.2, and 0.3 c.c. the first week; 0.3, 0.4, and 0.5 c.c. the second week, and so on. The animals were bled one week after injection. The streptococci for agglutination, directly from the tonsils of patients with arthritis, from the joints of rabbits, and from the tonsils of normal persons, were grown in glucose-brain-broth for eighteen hours, centrifuged, and suspended in one-fifth the amount of sodium chlorid

FOCAL INFECTION IN ULCER OF THE STOMACH

solution. In many instances, a clumpy growth occurred in the broth, in others agglutination occurred promptly in the sodium chlorid solution suspension, and still others were agglutinated as markedly by the normal as by the immune serum. All of these strains were discarded. Twenty-nine cultures of streptococci from twenty-one persons were subjected to the agglutinating effect of the immune and normal rabbit serums. Of these strains, seventeen were from patients with arthritis, and four from the tonsils of normal persons or from those suffering from conditions other than arthritis. None of the four control strains were agglutinated markedly by the immune serum.

In twenty-three of the twenty-five tests with the arthritis strains, agglutination was more marked and often occurred in much higher dilution in the immune than in the normal serum. All of the strains that were agglutinated by the immune serum produced green or slightly hæmolytic colonies on blood-agar. Agglutination was somewhat more marked and occurred in higher dilutions of the serum prepared with the freshly isolated strain than in that prepared after preservation in glycerin for three months.

CONTROL EXPERIMENTS

In these two series of experiments, it was found that the strains obtained in cases of gastric ulcer and arthritis produced lesions in the organs of rabbits corresponding to those affected in the patients, also in other organs but in much lower percentage. It was considered very important, therefore, to see what changes could be produced in the organs of rabbits by strains of streptococci from the tonsils of patients not suffering from any diseases resulting from focal infections. For this purpose, I selected the tonsils of young persons who had their tonsils removed on account of recurring attacks of tonsillitis or on account of their large size. The technic was the same as in the other experiments.

Fifty-five strains were injected into 102 rabbits, and necropsy was performed on the third day after injection. The percentage incidence of lesions in these experiments is given in Table II. The lesions in the stomach consisted only of hemorrhages in the mucous membrane along the lesser curvature near the pylorus. They were smaller and occurred less often than in the experiments with the ulcer strains.

GENERAL DISCUSSION

Streptococci, usually in large numbers, were found in the tonsils constantly, those of the viridans group usually predominating in incidence and number.

Dilated crypts, believed to be the result of fibrous adhesions, and filled with pus containing numerous streptococci and other bacteria, were found in the tonsils of many patients having ulcer of the stomach and arthritis. The value of tall tubes of glucose-brain-broth which afford a gradient of oxygen pressure is illustrated by the fact that platings from eighteen-hour cultures in this medium often gave pure cultures of streptococci, whereas direct platings of pus from the tonsil yielded streptococci, staphylococci, *Micrococcus catarrhalis*, and other bacteria.

The lesions in the stomach and joints not only occurred in a higher percentage of animals, as indicated in Table II, but also were more marked following the injection of the respective specific strains than following injection of non-specific strains. In the case of the arthritis strains a larger number of joints were involved.

The findings in the ulcer experiments resembled those in the spontaneous disease in man. The animals with ulcer often appeared well; the location of the experimentally induced lesions and the number of organisms in the deep layers of the margins of the ulcers were similar to those in patients.

In many respects the findings in the arthritis experiments also resembled the arthritis noted in the patients. The joints most markedly attacked showed erosion of synovial and cartilaginous lining; there was usually extension to the periarticular structure; the streptococci in the free fluid were few or none. The large joints, both in animals and man, subjected to the greatest stress and strain, were most frequently involved. Specific lesions developed only when small doses of the streptococcus from the pus expressed from tonsils *in situ* and from the small quantities of the broth culture, were injected.

The virulence of both the ulcer and the arthritis strains was low. Most of the animals apparently remained well after injection, and the blood and non-specific organs soon became sterile. Because of this and the marked stimulation of antibodies, healing began early. Frequently repeated onslaughts, such as we have reason to believe occur over long periods through chronic foci of infection, no doubt are often necessary for the development of chronic ulcer of the stomach and arthritis. The demonstration, by Davis and Wood, of streptococci passing the epithelial lining of crypts in tonsils, and the fact that Rosenow and Meisser produced urinary calculi by devitalization and infection of the pulp cavity of teeth in dogs with streptococci from nephrolithiasis, no longer leaves any doubt that invasion from chronic foci occurs. The bacteria in the tonsils and other foci of infection and their toxic products are considered to be always in conflict with the defensive mechanism of the host. Fluctuations in virulence from exposure to cold or from other causes occur; peculiar invasive power may be acquired and for mechanical reasons afford abundant opportunity for entrance of the living bacteria and their products.

The characteristics of the streptococci isolated were variable. The organism was subject to the medium in which it existed and appeared in short or long chains; its fermentative power, while often persistent, was affected by the medium; the virulence varied, and the power of attacking certain tissues was often very labile on subculture and animal passage. As an example, a pure culture of hæmolytic streptococcus was obtained at necropsy from the blood of a person who was found to have had acute ulcer of the stomach and duodenum as a result of extensive burns of the third degree. The primary culture produced marked hemorrhage of the stomach in two rabbits injected; the fourth daily subculture in glucose-brain-broth, which was injected into three rabbits, produced hemorrhagic ulcer in only one, whereas the sixth subculture had no effect on the stomach in two rabbits injected.

My findings are in agreement with those of Rosenow with regard to the importance of foci of infection and elective localization of streptococci in arthritis and ulcer of the stomach, the lack of elective localizing power of

FOCAL INFECTION IN ULCER OF THE STOMACH

control strains, the labile character of the property on which the elective localizing power depends, especially in cultures with a high oxygen tension, and the need for strict attention to technical details in elective localization studies.

CONCLUSIONS

The tonsils of patients suffering from ulcer of the stomach and arthritis commonly harbor streptococci which tend to localize, respectively, in the mucous membrane of the stomach and in the joints of animals, and produce ulcer and arthritis in them which is not true of streptococci in the tonsils of normal persons. Hence, it may be concluded that foci of infection harboring streptococci having elective localizing power are important factors in the primary cause and the persistence of ulcer of the stomach and arthritis.

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GUMMA OF THE BREAST; ITS DIFFERENTIAL DIAGNOSIS FROM CARCINOMA*

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IN MANY instances the accurate diagnosis of breast conditions is most difficult. This is due chiefly to three causes:

I. The numerous manifestations of the normal breast; or the near normal breast; such as a thin breast, a fat breast, a pregnant breast, an involution breast following pregnancy, etc.

II. The varying phases of the normal breast due to the person's *age*; such as a breast of puberty or the atrophy and involution of the breast past the climacteric.

III. The multiple and widely varying forms taken by each of the well known diseases of the breast; such as carcinoma, fibro-adenoma, chronic mastitis, cysts, traumatic fat necrosis,¹ etc.

Other reasons for difficulty in breast diagnosis lie in the lack of help afforded by the anamnesis. The history of any given breast condition is less pathognomonic and less helpful for working out an exact differential pathological diagnosis, than the history which goes with a duodenal ulcer, or a gall-bladder disease. One must take the aid supplied by the available history; but he must chiefly rely upon our sense of careful scrutiny; and a sense of delicate touch.

In this paper the author will not attempt to differentiate gumma of the breast from the normal variations of the organ, nor from the changes due to the age of the patient; nor from the majority of the well known diseases of the breast. But since it is a common error to mistake gumma for carcinoma, our attempt will be to emphasize a number of points in diagnosis which will place gumma of the breast in a clean-cut category of disease so that more gummata will be recognized; fewer will be operated upon; and more patients will retain their breasts.

Virchow in 1861 said "concerning syphilitic tumors of the breast we know very little"; he states that he welcomed an opportunity to study one.

Lancereaux declared that "any one who had not observed the commencement of this affliction and did not know the antecedents of the patient, would be unable to distinguish this tumor from that known under the name of scirrhus of the lactiferous ducts."

Edward Martin² says "The diagnosis from cancer may be quite impossible except from a consideration of the associated symptoms and the result of the therapeutic treatment."

* Read before the Clinical Research Society of New York City, January 31, 1923.

GUMMA OF THE BREAST

Even those surgeons who see an extraordinarily large number of breast cases, have rarely seen a gumma of the breast. In fact the *rarity* of the condition is where the responsibility lies for its non-recognition; because it

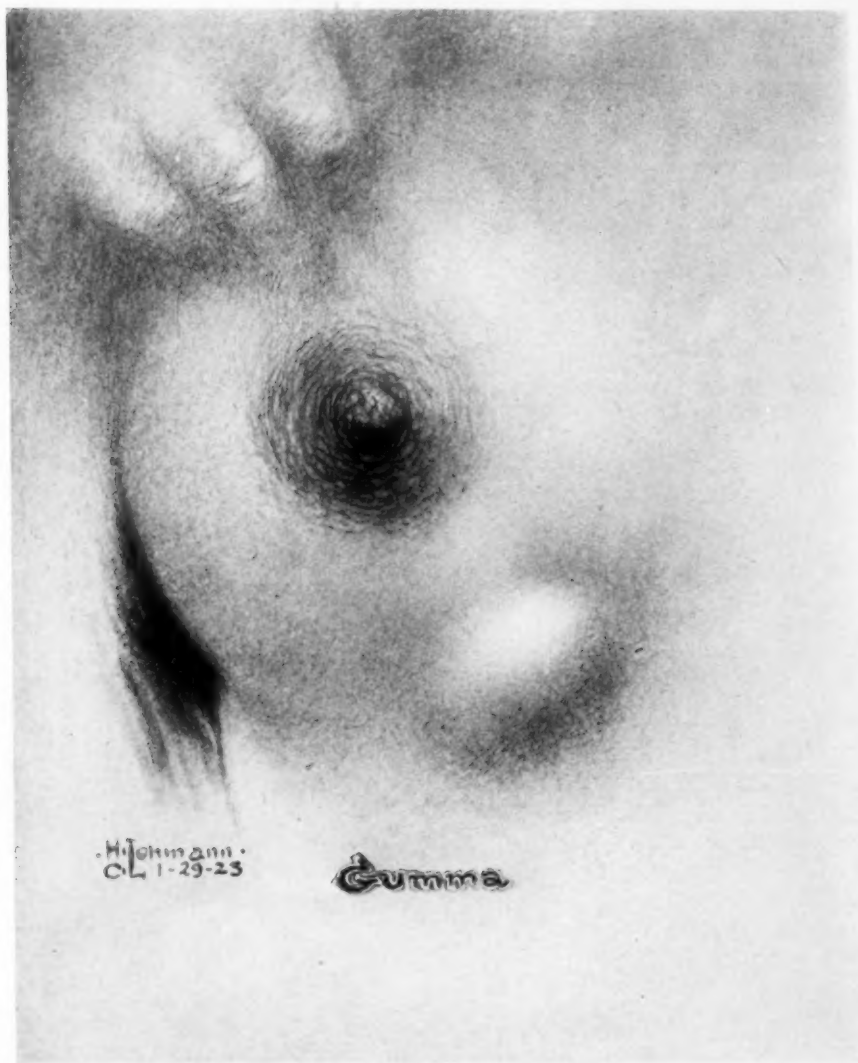


FIG. 1.—Gumma of breast.

has sufficient in the way of history, appearances and characteristic attributes, to definitely be diagnosed before coming to the operating table.

In the Breast Clinic of the Memorial Hospital conducted by Dr. B. J. Lee and the author, we see large numbers of breast cases with malignant and non-malignant conditions. But this is the only case of gumma which we have had during the period in which 1674 cases of carcinoma have been observed. It

is therefore obvious that gumma is a rare breast tumor. The following is the case report of a patient who came to Memorial Hospital August 14, 1922:

R. G., age thirty-five, female, married. Due to the fact that she spoke a Hungarian dialect only a poor history could be elicited. In brief it is as follows:

Family History.—Negative.

Personal History.—One year ago she had an operation at Mt. Sinai Hospital for "red spots" over the outer part of right shoulder. Otherwise, history is negative. At a later date through an interpreter the following supplementary history was obtained; but not until some time after her operation. It would have been an aid to diagnosis had we obtained it before our operation. The patient had one miscarriage during her first year of married life. Husband had had syphilis four years before his marriage. He had had no treatment. Otherwise the history is negative.

Mammary History.—About five months ago, the patient noticed a lump (Fig. 1) in the lower inner portion of the right breast, situated at the fold of breast with chest wall. This has increased considerably in size in past three weeks and has recently begun to give slight discomfort. No treatment has been given except application of salves locally. There is no history of trauma.

Physical Examination.—Patient is a middle-aged woman, with rather a pasty complexion.

Head.—Eyes react to light and accommodation.

Nose.—Negative except for a slight scar and redness of the skin of the nasal septum.

Mouth.—Teeth Poor. Marked pyorrhœa. No leucoplakia.

The outer aspect of right shoulder shows an irregular scar of a former operation. (Fig. 2.)

Chest.—Heart. Sounds are normal. Not dilated. *Lungs.*—There are occasional sibilant sonorous râles over lungs posteriorly, especially on right side.

Abdomen.—Negative. *Lymph-nodes.*—There is slight enlargement of the entire system, but it is not marked.

Surgical Condition.—There is a tumor of the right breast situated at the fold of breast with chest wall. It appears about the size of a hen's egg bisected on its long axis; tumor is dome-shaped. It has a reddish-bronze color and is very hard in consistence; smooth over its surface; fairly sharply circumscribed; seems to be part of and attached to the skin; measures about 6 by 4.5 cm., and is elevated from the chest wall about 2.5 cm. at its peak. The tumor is movable on the chest wall and has no deep attachment. It is not tender to palpation. There is no nipple retraction; and no orange-peel skin appearance. Remainder of the breast is negative. Left breast is negative. The nodes in both axillæ are palpable but not sufficiently enlarged or hard to make a diagnosis of carcinomatous involvement certain. However, mental reservation was made on this point. There was one node in the left supraclavicular region which is hard and markedly enlarged.

The above physical examination was made by our admitting physicians who felt it was carcinoma of the breast; and they sent it to me for operation. The patient did not return for operation until ten days later. When she came the picture had changed in two respects; namely, there was a slight elevation of temperature of the tumor itself; and also a suggestion of fluctuation at the apex of the tumor. At the periphery it was very hard. In fact most of the tumor had the stony hardness of carcinoma. The skin had become deeper bronze color. My feeling was that this was some unusual form of infection. So instead of doing the radical breast amputation for carcinoma, an incision was made directly into the tumor. There exuded about 30 c.c. of dirty looking, liquified necrotic tissue, which did not simulate pus. A section was removed for microscopic study, from the

GUMMA OF THE BREAST

thick indurated wall. The part of the tumor which was not necrotic was hard and appeared very cellular and oedematous; it simulated sarcoma tissue. The diagnosis was still uncertain so the cavity was packed. Further procedure was



FIG. 2.—Showing scar of former operation on right shoulder.

to be guided by the microscopic report. Later the pathological report came that the tissue showed an infective process; with no evidence of neoplasm.

The subsequent course of this case was, that the wide open wound drained profusely for about a month. The bottom of the wound was covered with grayish, dirty, necrotic material. The sharp edges of the wound became red, thick, and clean-cut overhanging the excavated cavity. It was typical of a syphilitic ulcer. This condition persisted with not the slightest attempt at any reparative process. On two occasions, the slides were reviewed with a pathologist to ascertain his

FRANK E. ADAIR

impression as to whether or not it might be a tubercular process. It was at this juncture that we secured the interpreter who gave us the history of the syphilitic infection of the husband; and the miscarriage in the patient. Blood was taken for a Wassermann test; and it was reported four plus.

The slide was reviewed by Dr. James Ewing whose report follows: "The specimen consists of fat tissue very thickly infiltrated with lymphocytes and

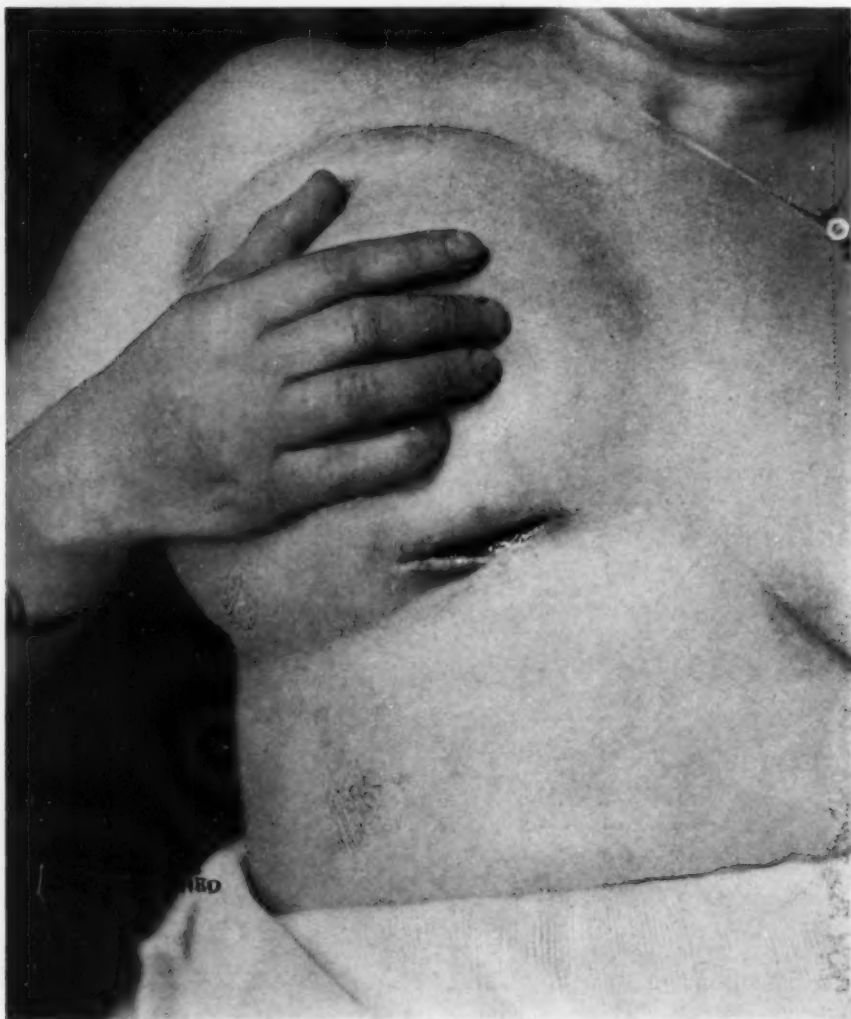


FIG. 3.—Showing wound of operation healing under the influence of salvarsan internally.

plasma cells. Some large arteries show lymphoid infiltration of the adventitia. There is no necrosis. Polymorphonuclear leucocytes are very abundant throughout. The lesion may be interpreted as a gumma."

I asked Dr. F. F. Mandlebaum, Pathologist to the Mt. Sinai Hospital, to review his sections of the tissue ("red spots") removed from the right shoulder, May 22, 1921, when the patient was operated in that institution. His report is: "Although the essential lesion is that of a purulent inflammation, there are some

GUMMA OF THE BREAST

vascular changes, which, in view of the further development in the case, may be interpreted as due to syphilis."

An X-ray plate was made of the ribs to see if this gumma might have some connection. Doctor Herendeen reported it "negative for bone involvement."

The patient was given seven doses of salvarsan which by January 15, 1923 entirely healed the gumma—four and one-half months after the patient was first seen.

Figure 3 shows the process when five doses of salvarsan had been given; a short time before the wound healed.

One will usually find some other evidence of a tertiary lesion associated with a breast gumma; in this case it is the nasal septum and the skin lesion (Fig. 2).

The natural history of gumma of the breast is more readily comprehended if divided into the following six periods:

First Period.—A lump appears which is painless, smoothly surfaced, very hard, shapely circumscribed, freely movable in the breast. There is no nipple retraction unless the tumor lies in close proximity to the nipple.

Second Period.—The tumor usually grows outward. It begins to involve the subcutaneous tissues. There may or may not be "orange-peel" appearance. The overlying skin becomes attached to the tumor.

Third Period.—The tumor in its growth pushes outward the overlying skin; and the skin becomes incorporated as a part of the tumor. The skin takes on a blush tint.

Fourth Period.—The tumor has increased in size; the skin has become purple or bronze due to the pressure and the stagnant blood supply. The centre of the tumor softens; and later becomes fluctuant. As it softens it becomes slightly tender. It now has a dome contour; and is shaped like a hen's egg bisected along the long axis.

Fifth Period.—Due to pressure necrosis, the skin becomes so thin and unhealthy that the gumma perforates and the necrotic material drains out.

Sixth Period.—After evacuation of the contents, a typical, crater-like, dirty, gray, sloughing, foul, deep syphilitic ulcer remains. This stage will remain until the patient receives anti-luetic treatment.

The great importance of this tumor lies in the fact that during the first three or four periods above described, it so simulates carcinoma of the breast, that it is most difficult to distinguish, and only with the most minute consideration will it be possible to do so before the tumor has reached the Fourth Period. After this stage the diagnosis is more simple.

The fact that a patient has had syphilis must not have too strong a bearing against the diagnosis of carcinoma; for we occasionally see a carcinoma in a luetic subject. Incidentally this group fare much worse than when carcinoma of the breast is not on luetic soil.

There are points which gumma and certain types of carcinoma have in common: namely, (1) stony hardness; (2) sharp circumscription; (3) painlessness; (4) skin involvement.

There are some characteristics of gumma usually not found with carcinoma. These are of diagnostic aid: (1) history of syphilitic infection;

miscarriage, etc.; (2) presence of other syphilitic manifestations; (3) bizarre involvement of the lymph-nodes; (4) tumor egg-shaped; (5) rarely orange-peel skin appearance; (6) gumma grows faster than carcinoma; (7) nipple never retracts unless lesion lies very near it; (8) fluctuation is the rule at one stage; (9) tenderness at this stage; (10) at later stage of ulceration the axillary nodes become markedly involved; (11) Wassermann test positive; (12) therapeutic test with salvarsan.

In carcinoma, the regional lymph-nodes do not become involved in any bizarre or irregular fashion; but they follow the definite rule that on the side of the lesion, the axillary and low-lying cervical "signal" nodes are involved first. Also in carcinoma, nipple retraction or a nipple slightly "stuck" is one of the *very early* signs; this point cannot be over emphasized.

In the following analysis of the 45 case reports previously recorded, one notes that the first report was 155 years ago, by Sauvages in 1768. It is interesting that it was a hundred years later before the disease became sufficiently recognized to merit a place in the text-books on breast diseases. Gromo's³⁴ thesis was an impetus because he was the first to collect the case reports. It seems strange that in searching the literature, one finds but 45 cases recorded. A study of these cases is unsatisfactory because of lack of information on which to base a diagnosis. One is struck with the confusion of gumma with carcinoma. Such terms as "pseudo-scirrhous" and others equally vague, are common. Pathologic fractures are recorded. Some "died from the disease." In New York one case was shown before a Dermatological Society²⁹ as a case of Paget's Disease; the same case later was presented as a gumma. The case of Patterson³⁰ in England is interesting. His case was confused with malignant disease. He made an ante-operative diagnosis of carcinoma; he performed a radical breast amputation before a surgical society. On gross section it appeared to be sarcoma. He brought out the point that grossly the fibrous tissue of this tumor so simulated sarcoma that he wondered how to avoid making a similar mistake in diagnosis.

Age Incidence.—There are 33 cases recording the age of the patient; eight cases reporting no age. There is one case in a congenital luetic child; two, in "old woman"; one in "middle age"; and one, in "young lady." According to decades:

1 to 10 years — 1 congenital child.
 10 to 20 years — 2 cases.
 20 to 30 years — 6 cases.
 30 to 40 years — 10 cases.
 40 to 50 years — 8 cases.
 50 to 60 years — 6 cases.
 62 years — 1 case.

Sex Incidence.—Of the 35 cases recording sex, it was 3 times present in men and 32 times in women.

GUMMA OF THE BREAST

Syphilitic History.—Of the 46 cases here recorded, 19 (41 per cent.) give definite syphilitic history. Lesions of lues other than gumma also were reported in 19 cases (41 per cent.). Unquestionably many such lesions were overlooked.

The diagnosis of gumma will chiefly depend on an exact detailed study of the *tumor itself*.

Size.—The most common size is that of a hen's egg. By this I presume most authors mean a hen's egg split on its long axis—in reality half an egg. The size is one of the most striking points. In going back to the original sources of these 45 cases reported from Italy, Netherlands, Germany, Scotland, France and America, it is interesting to note that the most descriptive term which came to the mind of these authors widely scattered in different countries, and separated by a space covering 155 years, was that of the "hen's egg."

The size was recorded in 29 cases; and in 11 cases it was the size of a "hen's egg"; 1 case, a "dove's egg"; 1 case, a "pigeon's egg"; 2 cases, a "small apple"; 2 cases, "an apple"; 1 case, "a lemon"; 1 case, a "hickory nut"; 2 cases, "a nut"; 1 case, a "thumb"; 1 case, a "button" 1 case the "head of an infant," the latter being the *only* case recorded in which the tumor grew to any great proportion. Five cases had the exact measurements given, and these, with one exception, corresponded to about the size of an egg. Therefore in diagnosis this size is one of our most important points.

Consistence.—One of the most impressive characteristics of gumma is "stony hardness." This consistent feature is responsible for it being mistaken for cancer. The hardness is maintained up to the period where necrosis begins in the centre, due to poor blood supply. In 17 cases such expressions as "densely hard," "hard," "the hardness of scirrhus," etc., were used.

It is an interesting fact that 7 of these 17 cases, *during the period of observation*, became soft or fluctuant; and 6 of the 17 cases were observed to go on to ulceration. This shows the later stages of the life history very clearly. There were thirteen cases which either ulcerated while under observation, or were ulcerated when the patient first came.

Surface.—In 21 cases the tumor was rounded. It is a smooth roundness from base to apex of tumor; and the peak is a rotund dome.

Color.—The color entirely depends on the stage of the disease:

(a) At first there is no discoloration of the over-lying skin.

(b) Later due to pressure by the tumor against the dermal vessels and capillaries, the skin takes on a faint blush; then a bluish-red; then purple; later bronze.

(c) At this juncture skin necrosis sets in, and it is a lead color.

(d) The dirty color of ulceration is the last stage.

Tumor Edge.—The base of the tumor as a rule has a definite, sharp edge. It is in no way comparable to an infiltrating carcinoma. In 8 cases where there is mention of the edge of tumor, seven had sharp, well defined edges. In only one case was it indistinct.

Pain.—One of the chief diagnostic points is painlessness at first. It is only in the later stages of tumor softening that pain is present. Thirteen of the tumors were painless; two of these 13 *while under observation* became painful. Five tumors were painful. The tumor is not tender to touch. It is tender only after fluctuation has appeared.

Movability.—The tumor is usually movable in breast tissue. In those cases where the point is discussed 8 cases were freely movable and only one had deep attachment.

Rate of Growth.—The tumor develops rapidly in comparison to most breast tumors; and goes on to quick ulceration. In Lapowski's case ²⁹ the tumor grew in three months; in Bruc's case ²⁶ the growth was "rapid"; in the author's case it took five months.

Skin Attachment.—Little aid is given on analysis of this point. Of 14 case reports mentioning this, 5 have no skin attachment, 6 have definite attachment, and 3 have tumor fusion with the skin. This point depends on the period of the disease. Early there is no attachment; late there is fusion.

Nipple Retraction.—In the eight reports mentioning this, 5 had definite retraction and 3 did not. But where so large a proportion of the 45 cases do not mention it, probably there was no retraction. Nipple retraction will occur only when the gumma lies in close proximity to the nipple.

Axillary Node Involvement.—In the 21 case reports mentioning this, 12 cases had no palpable involvement. Nine cases had definite enlarged nodes in the axilla of the side of the breast lesion. One states that the axillary mass of nodes is the size of an egg. Axillary node enlargement comes particularly at the time of ulceration; but is not to be expected before this stage. Delbert ³⁵ states there are no axillary nodes; and gives this as an important differentiating point.

Supraclavicular Node Involvement.—Six cases had supraclavicular involvement; and six cases had the supraclavicular group combined with other lymphatic manifestations. There is great irregularity as to which supraclavicular nodes become involved.

Breast Involvement.—(a) One breast only was involved in 19 cases, in which this was mentioned. The probabilities are that the 18 cases in which this point was not mentioned had but one breast involved.

(b) Eight cases had gummata of both breasts.

(c) Seven cases had more than one gumma in the same breast.

(d) In one, the gumma lay between the breasts.

Wassermann Test.—In only three of the 46 cases was the test made. They were all positive. It is interesting to note in 1912 in the case of Yvert ³¹ which he had in the rural districts of France, that "a Wassermann was considered but not made because it cost too much for the test."

Microscopic Examination.—Aside from the case of the author, it has been made in only two previous cases. Had it been more frequently made we would have found more cancer cases in this series; and fewer gummata.

[illegible]

TABLE I.

Tumor shape	Tumor color	Tumor edge	Tumor painful	Tumor painless	Tumor ulcerated	Movable in breast	Rate of growth	Skin attachment	Deep attachment	Nipple retracted	Orange peel skin	Axillary nodes	Supraclavicular nodes	General glandular enlargement	One breast	Both breasts
ounded			+		O										+	
ounded	Became bronzed Lead dirty	Sharp	Later +	At first +	O +			Fused		+					+	B the
	Not discolored		+		Just + starting O			Fused	+			O +				
ounded	Brown		+			+		+				Hard +			+	
ounded	Reddish brown				O	+		+								
ounded	Not discolored Normal					+	Slow	O				+	+	+	+	
ounded				+	+ Later +	+			O			O O			+	
ounded								O							+	
					+					+		Only one			+	
ounded	Reddish														+	
			+							+						

al lar ment	One breast	Both breasts	More than one tumor	Wassermann report	Microscopic report	Diagnosis	Surgical treatment	Anti- luetic treat- ment	Remarks.
	+					Cancer	+		Removed because would not heal.
		+						+	Tumor disappeared under medica- tion. Author thought it "special type of cancer".
	+		+			Scirrhus	+		Incision drained pus. Remained indurated.
	+	Between the breasts	+			"Pseudo scirrhus"			
		+			+			+	Cured.
	+							+	Cured.
	+							+	Cured.
		+				Cancer	Refused	+	Cured. Case autopsied. Billroth doubted its authenticity.
		+							
	+							+	Cured.
	+	+					+	+	Improved at first. Later died, gen- eralized. Breast amputated. Got spontan- eous fracture of femur. Died.
	+						+	+	Cured.
	+							+	
	+							+	
		+	+			Non-malignant tumor	+	+	Wound broke down. Healed by antiluetic treatment.

axillary nodes	General glandular enlargement	One breast	Both breasts	More than one tumor	Wassermann report	Microscopic report	Diagnosis	Surgical treatment	Anti-luetic treatment	Remarks.
0	0	+								
0		+	+	+					+	Cured.
0				+						
0	0	+		+					+	Cured.
				+		0	Scirrhus cancer	+	+	Due to bad heart condition, operation at first not done; anti-luetic treatment. Later operation because so large.
opposite +	Opposite axilla 1 node					+	Cancer Cancer			Patient refused operation.
+		+		0			Others—cancer, beer, syphilis		+	Cured in one month.
		+					Sent for cancer operation			Indurated growth.
+										
+	+	+	+				"Paget's disease" (cancer) Cancer	+	+	Shown first before society as a Paget's disease. Later treated by drugs. On section looked like sarcoma. Radical operation. Two weeks later ulcerated and knew it was syphilis.
0	0				"Not done, cost too much"		Cancer			
0	0						Cancer			
		+			+				+	Cured
		+			+				+	
opposite +	Slight +	+		0	+	Gumma +	1. Cancer 2. Infection	Simple incision +	Later +	Sent for radical operation for cancer. Incised on diagnosis of infection. Wound would not heal. Anti-luetic treatment, cured.

GUMMA OF THE BREAST

Preliminary Diagnosis.—One of the most striking points of the analysis is, that of the 15 cases in which diagnosis was made before operation, or before the diagnosis became self evident by the progress, 14 cases were definitely diagnosed as cancer; and only one case as a non-malignant condition.

Treatment.—(a) In 20 cases anti-luetic treatment was given; of these the records state 13 were cured.

(b) In eight cases surgical treatment was resorted to; some had a radical amputation of the breast and axillary contents. Some had less radical surgery performed. Some refused surgical aid.

One patient died and an autopsy was made. Billroth doubted the authenticity of this being a gumma. In another case, the patient got a spontaneous fracture and died. In these last two cases it requires little imagination to see the confusion between gumma and carcinoma in this series of reported cases. (See table of analysis of 46 cases.)

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Reported by year	Patient's age	Male	Female	Syphilitic history	Other signs	Tumor size	Tumor hardness	Soft or fluctuant	Tumor shape	T
Neumann ¹⁹ , 1889.....	27		+			"Apple"			Rounded	T
Malfeso ²⁰ , 1890.....	Record of case not obtained									
Ostermayer ²¹ , 1893.....	26		+	+	+	"Egg"	+		Rounded	B
Ostermayer ²¹ , 1893.....	50		+		+		+			Ver
Emery ²² , 1896.....	30		+	+	+	"Nut"			Rounded	
Legrain ²³ , 1897.....	50		+	0	0	"Button"				Br
Kennedy ²⁴ , 1902.....	30		+	+	+	"Pigeon's egg"	+	Became + soft	Rounded	Firs
Heller ²⁵ , 1903.....	62		+		+	"Apple"	+	Became soft +	Rounded	Late
Heller ²⁵ , 1903.....	?									
Bruc ²⁶ , 1903.....	56		+	+			+			"D
Beer ²⁷ , 1905.....	35		+			6×7.5 cm.		+		
Bissel ²⁸ , 1907.....	32									
Bissel ²⁸ , 1907.....	48		+	+		"Lemon"	+	Became +	Rounded	
Bissel ²⁸ , 1907.....	"Middle age"									
Bissel ²⁸ , 1907.....	39			+		"Small egg"			Rounded	
Bissel ²⁸ , 1907.....	35									
Lapowski ²⁹ , 1908.....	56		+	+		7×7 cm. "Orange"	+	Became +	Rounded	Nor
Patterson ³⁰ , 1909.....	26		+				"Densly + Hard"			Lat
Yvert ³¹ , 1912.....	46		+			"Egg"	+		Rounded	Lat
Yvert ³¹ , 1912.....	?					"Egg"			Rounded	
Chevannes and Loubet ³² , 1913.	"Young lady"		+		+	"Egg"			Rounded	Lat
Thompson ³³ , 1920.....	33		+		+	10×4 cm. "Walnut"			Rounded	
Adair, 1923.....	35		+	+	+	6×4.5×2.5 cm. "Egg"	+	Became +	Rounded	Blu

TABLE I.—Continued.

Tumor shape	Tumor color	Tumor edge	Tumor painful	Tumor painless	Tumor ulcerated	Movable in breast	Rate of growth	Skin attachment	Deep attachment	Nipple retracted	Orange peel skin	Axillary nodes	Supraclavicular nodes	General glandular enlargement	One breast	Both
rounded				+	+							0	0	0	+	
rounded	Bluish Very red	Sharp Sharp			+	0		+				+	0		+	
rounded	Bronze	Sharp	+	+	Later + +			+	0	+	+	0 + Size egg	0			
rounded	First red. Later blue red			+		+		0				0	0	0	+	
rounded																
	"Dark"				Later +		Rapid		0	0		0	Opposite +	Opposite axilla 1 node		
		Indistinct		+				0		0		+	+		+	
rounded		Sharp													+	
rounded				+			Slow			+			+			
rounded	Normal at first. Later red	Sharp		+	Not at first Later +			+				+	+	+		
				+			Three months	0	0			0			+	
rounded	Later red			+	Became +							0	0	0		
rounded					+							0	0	0		
rounded	Later red			+		+		+				+			+	
rounded				+								0			+	
rounded	Bluish red	Sharp	Later + slight	+	0	+	Five months	Fused	0	0	0	0	Opposite +	Slight +	+	

FRANK E. ADAIR

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THE LIVER AND ITS RELATION TO CHRONIC ABDOMINAL INFECTION*

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THE liver, probably the most important organ in the body excepting the brain, has long remained an enigma of clinical pathology and symptomatology. It has been habitually associated in the minds of the laity with "biliousness" and torpid liver, and the various cholagogues and remedies for supposed hepatic insufficiency are legion.

Pathologists have been endeavoring to explain the origin of a variety of liver changes that accompany or are terminal to widespread or local disease within the abdomen. This association has been so commonly observed and the relationship exhibited so casual that it has not aroused the interest that it ordinarily should have. The clinician has become acquainted, both clinically and pathologically, with a variety of hepatopathies, and has subdivided the diseases of the liver, excluding the acute affections, into those in which fibrous tissue elements were found about the periportal veins and typified by Laennec's cirrhosis and those in which fibrous tissue elements were found about the bile radicles with biliary stasis and typified by Hanot's cirrhosis. Midway between these two extremes have been classified a variety of affections with indistinct symptomatology and unclassified pathologic findings.

Since 1910, the writer has been particularly interested in a series of gall-bladder cases that have exhibited unusual and peculiar post-operative complications. The complications that may reasonably be expected after laparotomy for gall-bladder disease are clearcut and distinct and possess within certain limits a chronological sequence. In the first twenty-four hours the complications are anatomical, such as hemorrhage, shock, gastric dilatation and embolism. In the succeeding forty-eight to seventy-two hours the element of infection might possibly come into play, with the production of a peritonitis and still later, abscess formation. We have observed occasionally three clinical states that supervene after operations on the gall-bladder and biliary system, and more rarely after gastric or intestinal surgery, and which cannot be attributed to any of these factors. Although these clinical complications are comparatively rare, yet they are definite and apparently within their group, are rather characteristic in their symptomatology. For convenience of description we have classified them into three more or less distinct groups. The first group is represented by patients who have had comparatively simple gall-bladder operations. As a rule, the surgery has been confined entirely to the gall-bladder and the removal of the appendix. The patients are always obese and have a history of chronic gall-bladder disease extending

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over a long period of time. Preliminary study of the urine and blood has assured us as to the competency of renal function. They have been anaesthetized with gas and ether and a cholecystectomy and appendectomy performed. Following the operation the recovery from the anaesthesia is delayed, in fact, it may be said that they never completely emerge from their anaesthesia. They remain, for four to six hours after being returned to the ward, in a semi-comatose condition. They develop talking delirium, carphology, subsultus tendinum, which finally passes on into coma, with death. In view of the fact that the post-operative clinical syndrome suggested a distinct mental irritation, spinal punctures have been made with comparatively negative findings. The cell count has been ten or eleven cells per cu. mm.; globulin, one plus; Wassermann, negative. Preliminary studies seemed to suggest that there was no renal element in these cases, although coincident with the development of the delirium there is gradual diminished urinary output both in fluid quantity and in chemical elements. We were in the habit of attributing this condition to the development of a post-operative acidosis incident to the poor metabolism represented by chronic biliary disease, plus the additional elements of anaesthesia and surgical trauma. In making a complete study of these patients both before and after operation, Doctor Killian was able to show that the carbon dioxide combining power of these patients was far in excess of the normal and approached values of 70 to 80, and occasionally to 90 volumes per cent., and that the condition chemically is that of an alkalosis. In none of these patients in this group had there been a preliminary administration of alkalies, and we can reasonably exclude the suggestion of sodium poisoning. In the last two years in the collective service of the attending surgeons at the New York Post-Graduate Medical School and Hospital, we have been able to study six of these cases, four of which terminated fatally.

The second group is essentially different in its clinical manifestations. These patients, as a rule, have had a very severe type of biliary infection and there has been a history of jaundice and a previous gall-bladder operation. The patients have had a choledochotomy with drainage of the common duct and the post-operative progress has been satisfactory until about the end of thirty-six to forty-eight hours, when they become irritable and nervous. Within a very short time the patient passes into a pronounced vasomotor collapse with cold, clammy, "leaky" extremities. The condition is not associated with gastric dilatation and there has been ample renal function. The intravenous administration of glucose and saline and continuous Murphy proctoclysis with tap water has usually brought about a recovery. We have considered these cases as due to the liberation of some pancreatic toxin with inadequate liver protection. These cases do not exhibit the alkalization of the preceding group and their blood chemistry is only changed in so far as there is a change in the percentage of the rest nitrogen to urea nitrogen. The third group presents a still more difficult phenomenon in that the lethal complication occurs in patients who were apparently progressing favorably

up to the end of five or six days after operation. They were all patients with a clinical picture of calculous cholangitis, pancreatitis or rarely, malignancy of the head of the pancreas. At the time of operation their blood chemistry had been studied and the coagulation time, if necessary, had been brought within normal range by blood transfusion or the intravenous administration of ten per cent. calcium lactate. The operation had been undertaken for the relief of the pathologic condition of the gall-bladder and common duct or to institute biliary drainage either externally through the anterior abdominal wall or by the anastomotic union of gall-bladder to stomach. The immediate post-operative condition had been satisfactory. The icterus had begun to diminish appreciably in intensity and the dehydrated condition had been manifestly overcome by continuous Murphy proctoclysis of ten per cent. glucose. These patients had been fed their own bile where there was external drainage, either by swallowing, or by means of a stomach tube, so that it was reasonable to suppose that the lack of bile salts was not an element in their condition. The maintenance of normal bile salt content is essential because Cokeman has shown that the salts in the bile gradually diminish with external drainage to approximately one-tenth of the normal quantity. This mechanism would seem to suggest a conservative action upon the part of the organism to conserve the totality of bile salts present in the body. At the end of five or six days, occasionally ten days, with a constantly diminishing jaundice, these patients become somnolent, sleepy, and pass into a pronounced state of coma and die, irrespective of any remedial agents employed. The clinical picture presented is essentially a coma, occurring in a patient with a diminishing obstructive jaundice. In its manifestations it is not unlike the terminal stage of a portal cirrhosis with complete liver exhaustion. Some of these cases at operation showed "white bile," both in the gall-bladder and in the common duct. We have not regarded the presence of white bile as contributing to this condition, except in so far as it tended to indicate an increase in the immediate operative mortality. We have taken the explanation of Kausch that white bile represents a purely mucosal secretion and by and of itself has no deleterious qualities.

We have long felt that these three clinical conditions were in some way connected with an impaired liver function, either a disturbed liver metabolism, a liver dysfunction or a liver insufficiency. In the first type the rapidity with which the development of coma is brought about takes it entirely out of the infectious class, and while it is possible that the operation may have liberated certain deleterious products, the whole mechanism suggests a complete and rapid cessation of liver function. The second type of complication occurs too late for primary operative shock, and occurring as it does, in patients who have had a previous gall-bladder operation with palpatory injury to the pancreas, might be possibly interpreted as due to toxic inundation of the system and direct poisoning of the liver cells with cessation of function. In the third group there must be considered the possibility of an infection. The operation itself has been conducted in an infected field and various

encapsulated bacteria have been liberated, so that the mortality in this group might be explained by an increasing bacterial infection, yet clinically there is no evidence of it. We have unfortunately not controlled these cases with repeated blood cultures, a line of investigation we propose to pursue, but it seems more probable that these patients have had sufficient liver function to maintain a certain degree of bodily welfare and activity. When this is interrupted by a surgical operation, or there is thrown upon an already compromised liver the increased burden of detoxifying a further increment of deleterious products, the liver is unable to do so and the interim between operation and death represents the period of increasing and progressive exhaustion of liver capacity. The liver is notoriously able to handle infections and catabolic proteins that are the result of infection. If the dosage of these offending bodies is so great as to overwhelm the liver, or their toxicity is beyond the detoxifying power of the liver, it is a question only of time before the liver fails to give that protection which, under ordinary circumstances and even in the presence of a chronic abdominal condition, it has been competent to do up to this time.

During the course of these observations we were stimulated by the very splendid clinical report of Stockton, who was able to report in detail a progressive infection of the entire gastro-intestinal canal, later of the liver, and finally death with post-mortem findings showing marked degeneration in the liver. From the clinical and pathological point of view, Graham has clearly demonstrated the frequent association of disease of the gall-bladder with the pathological evidence of hepatitis.

Experimentally it has been possible to produce hepatitis by partial ligation of the common duct, and it is interesting to note that tropical abscess is almost invariably associated with the right side of the liver; the splenomegalias and gastric affections with the left side of the liver while diabetes, when it is associated with liver pathology, almost invariably exhibits the hepatic change in the right lobe. Reidel drew attention to the fact that the lobe of liver, which goes by his name, is confined to the right side, and Glenard states that Reidel's lobe was the direct result of inflammatory changes incident to gall-bladder disease. Hess and Seregé attempted to segregate certain functions of the liver as being peculiar to either the right or left lobe. Glenard intimated that there was a difference in function between the right and left lobe and the injection of staining fluid into various branches of the portal system was followed by unequal distribution throughout the liver, that from the superior mesenteric vein showing a predilection for right-sided distribution and that from the splenic vein, predilection for the left side of the liver.

In the liver we have a complete biochemic laboratory, approximating a weight of fifty ounces and a variation of ten per cent. over or under might be indicative of an hypertrophy or an atrophy. Enlargements of the liver clinically are extremely difficult to determine, as we have no accurate means during the course of laparotomies to estimate the size or weight of the organ and the determination of enlargement is predicated by the personal equation

LIVER AND CHRONIC ABDOMINAL INFECTION

of the operator. Again, there must be other biological factors in that some people are born with good livers and are able to withstand a degree of trauma that cannot be withstood by other individuals. The liver stands midway between the portal and systemic circulation and is interposed between the spleen and the heart. It receives the blood from practically the entire viscera of the abdomen, yet the amount of arterial blood given to the liver is extremely little, as the final divisions of the hepatic artery that go to the liver are extremely small in relation to the bulk of the gland. It has never been distinctly proven that there are arterial vessels that nourish the individual liver cells. The arterial branches apparently terminate in the interlobular connective tissue. The bulk of the blood that traverses the liver is venous, one-sixth to one-eighth of which represents splenic blood. This venous blood contains the biproducts of splenic bacteriolysis together with all of the food elements in varying amounts. The latter are to be translated into energy values by the action of the liver. The vital functions of the liver are carried on with practically only venous blood.

Preëminently the liver is concerned with the storage of glycogen, biologically probably the oldest established function of the liver. (2) It is intimately concerned with the metabolism of proteins, either simple or compound. (3) It exerts some ancillary function in connection with the metabolism of fats. (4) It has a pronounced influence on the coagulation of blood and with the development of fibrinogen. (5) It carries on bile formation and bile secretion. (6) It constantly exhibits a marked depurative or detoxifying function. In this connection it is interesting to consider another phenomenon of the liver, in that it has the most remarkable regenerative capacity of any organ in the body. When an organ is called upon to respond to additional work, it hypertrophies, and we have the common phenomenon of compensatory work hypertrophy. The liver, on the other hand, participates in no hypertrophy but shows a regenerative capacity of the highest degree.

Mann has been able to remove seventy per cent. of the liver and in a very short space of time—eight weeks—found complete regeneration of the organ. In addition, he has been able to ligate seventy per cent. of the bile ducts producing an atrophy with complete regeneration on the other side, and Rous and McMaster have ligated nine-tenths of the bile vessels without producing bile stasis or icterus. A very interesting paper by Pool and Bancroft drew attention to nodular hyperplasia, occurring in the midst of a completely atrophied and degenerative liver, the hepatic regeneration in their cases standing forth as hyperplastic islands of newly formed liver tissue. The individual liver cell is of the simplest type and it contacts on one side with the bile channel and on the other with the venous channels. It is susceptible to injury by any offending agent, biochemic or chemic, that may be brought to it and irrespective as to the character of the offending agent, manifests its intrinsic cell reaction by fibrosis on the one hand, with an almost equal amount of regeneration on the other hand. One has only to recall the innumerable cases of patients who have had a laparotomy and

the surgeon has found marked cirrhosis without any clinical evidence of the condition being apparent, due to the maintenance of hepatic function by active liver regeneration.

It would seem that a small area of liver tissue is quite capable of carrying on the normal functions of the body. The question that naturally presents itself for consideration is: What is the effect of long-continued infection in the abdomen in regard to changes in the liver? The association of gall-bladder disease with histologic evidence of liver degeneration is conclusively proven. In every one of Graham's operative cases with demonstrable pathology in the external biliary system there were the macroscopic and microscopic evidence of liver change. He was able to obtain on culture from the liver tissue the same bacteria dominant in the diseased gall-bladder. In the sub-acute and acute cases the liver was enlarged in sixty-seven per cent. of his cases; the edge cedematous and the changes more graphic than in the more chronic cases. Can we go further and demonstrate a hepatitis, either sequential to or concomitant with chronic abdominal infection in regions remote from the gall-bladder? About eighteen months ago at the Post-graduate Hospital, with the assistance of Doctor MacNeal, Pathologist, and Doctor Killian, Biochemist, we undertook a threefold study: (1) A critical study of all of the organs exposed during the course of all laparotomies irrespective of the original abdominal condition. (2) The removal of a portion of the liver from both the right and left lobes wherever mechanically possible, and (3) a pre-operative and post-operative study of the blood in relation to the known elements of blood chemistry. We have assumed that a partially obliterated appendix, or a completely obliterated appendix, represented the indubitable proof of an inflammation and that in this condition at least there must be continuous seepage of infective material or chemical biproducts into the portal system and which being carried to the liver, would manifest themselves in the histologic evidence of inflammation about the periportal system or the bile ducts. In this we were not mistaken, as is evidenced by the cases herein reported. We pursued the same line of investigation in regard to carcinoma of the stomach, and again in ulcer of the stomach, and likewise repeated the work of Graham on the relationship between manifest disease of the biliary apparatus and histologic changes in the liver.

While investigating this subject we would remove two or three small pieces of liver during the course of an operation. The first section removed was usually from the neighborhood of, or adjacent to, the gall-bladder, the second piece from the superior surface of the right lobe and about five cm. distant from the gall-bladder and less frequently from the superior surface or anterior border of the left lobe, depending upon the accessibility of this portion of the liver. It may be stated that when we found macroscopic liver changes present, the pathologic changes were uniformly distributed throughout the right lobe of the liver and at the same time there was always evidence of the same pathologic process in the left lobe, but ordinarily of less intensity than in the right lobe. It occasionally happened that the liver changes were

LIVER AND CHRONIC ABDOMINAL INFECTION

much more marked than the associated pathology in the gall-bladder, appendix or stomach. In other words, the changes in the abdominal viscera were

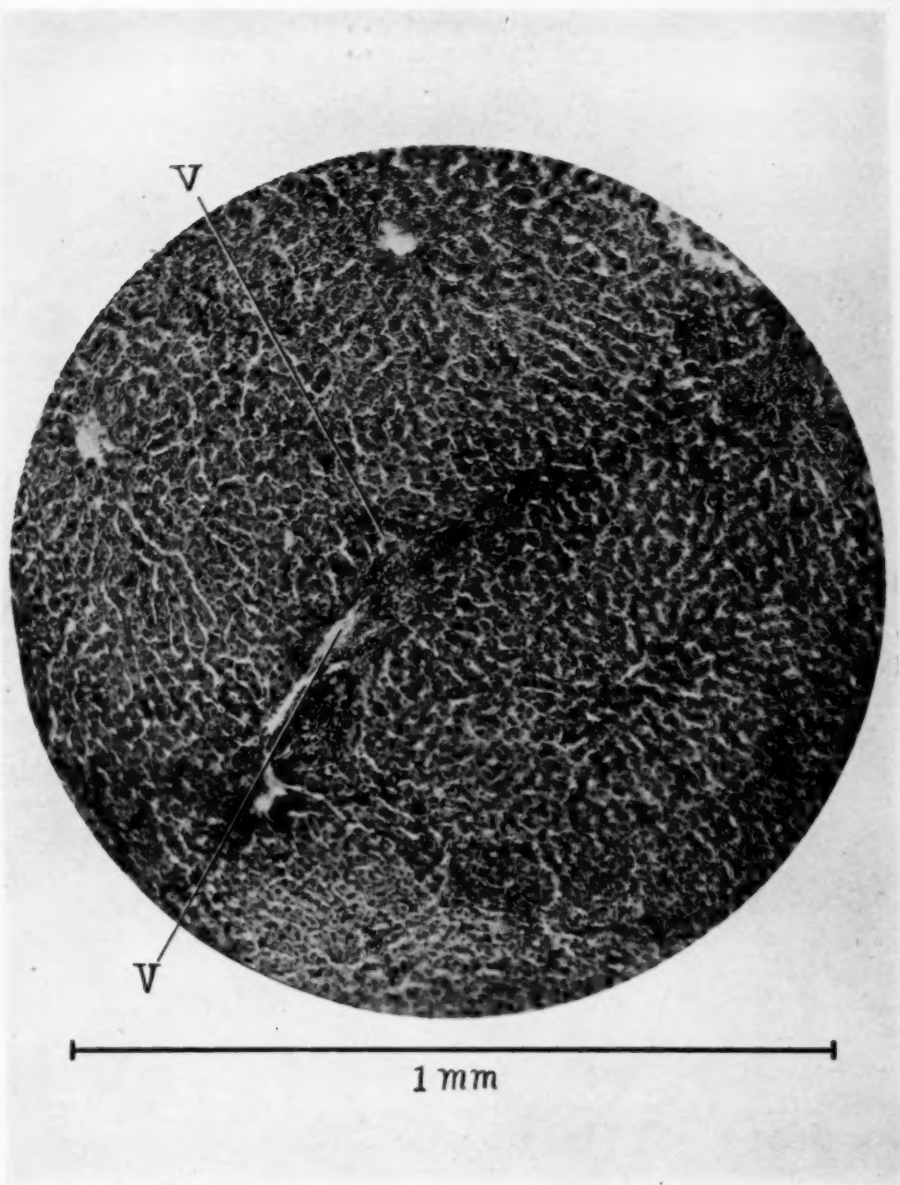


FIG. 1.—Case XIII. Section of liver, showing moderate thickening in the fibrous trabeculae of Glisson's capsule, with numerous wandering cells most abundant about the bile ducts. The picture is that of an irregular cirrhosis of an early stage, evidently of the biliary type. (V) Portal branches.

quite minimal as compared to those encountered in the liver. In so far as the gall-bladder was concerned as an etiologic factor in hepatic change, it did not seem to make much difference whether stones were present or absent.

The essential elements were apparently: (1) Chronicity of the infective processes; (2) the persistence of a certain degree of intensity of the offending agent, chemic or biochemic. In catarrhal types of appendicitis and cholecystitis, the evidence obtained from inspection of the liver consisted in a thickening of the capsule, with occasional adhesions, with thickening of the anterior border, with crenation, swelling and surface dimpling. In localized gall-bladder disease, the changes in the area of the gall-bladder region

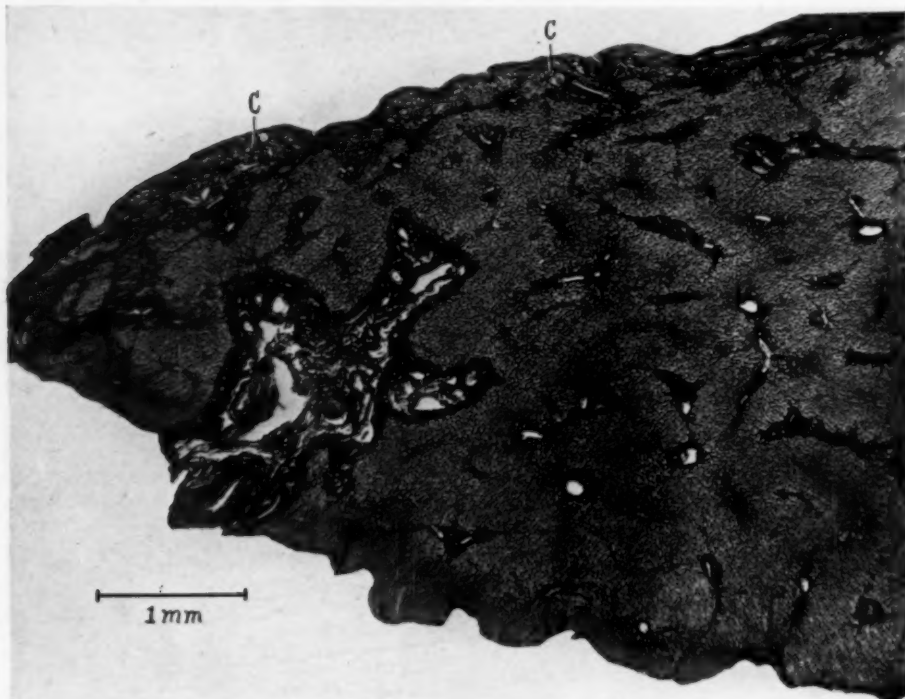


FIG. 2.—Case XVII. Section of liver, stained by Van Gieson's method to show the fibrous tissue, which is increased in the external capsule and in the trabeculae within the liver substance. This specimen also shows abundant round-cell infiltration of connective-tissue and conspicuous small bile ducts, features which are, of course, not evident in the photograph.

were more intense than elsewhere and the quality of the change varied inversely with the distance from the gall-bladder. In these cases the microscopic examination of the liver sections would show subcapsular lymphocytic infiltration and intercellular lymphatic infiltration. (Fig. 1.) If there were an acute inflammation in the appendix or gall-bladder, leucocytic infiltration would be merged with lymphocytic infiltration. When the abdominal condition was essentially chronic, the surface changes on the liver would become more marked and more diffuse, together with an increase in the size of the liver. The liver was grossly enlarged in about fifty per cent. of all the cases and the enlargement, when present, was confined, in about ninety per cent. of the cases, to the right lobe and particularly the outer and posterior half of the right lobe, the quadrate and caudate lobes not participating in gross enlargement. Microscopically, the liver changes in the more chronic cases

LIVER AND CHRONIC ABDOMINAL INFECTION

represented an advance in pathologic intensity, with the chronicity of the abdominal conditions. (Fig. 2.) Uniform fibrosis was more marked, loose connective tissue would be found in abundance about the bile ducts and portal veins, bile stasis would be more apparent with hyperplasia and budding of immature bile ducts. (Fig. 3.) Leucocytic and lymphocytic

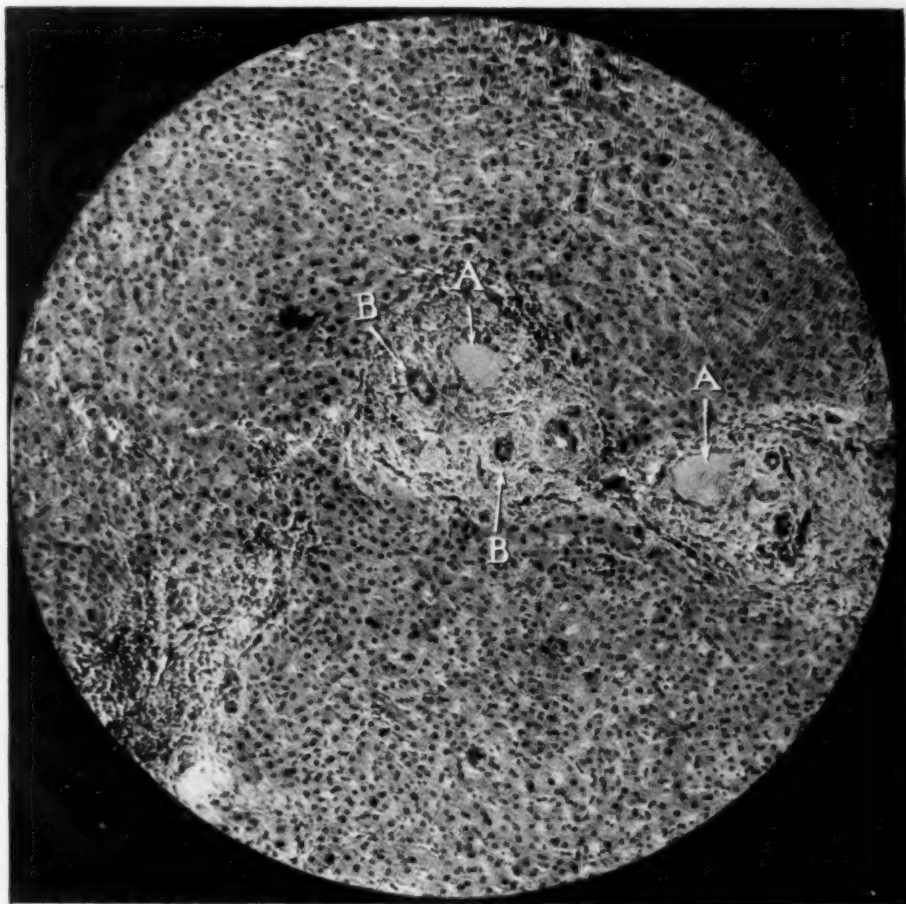


FIG. 3.—Case IV. Chronic interstitial hepatitis and moderately early stage of biliary cirrhosis. The fibrous thickening of the trabeculae is marked and evidently of long standing. The round cells appear to be closely related to the bile ducts. The liver lobules appear smaller, as if compressed. (A) Portal branches. (B) Bile ducts.

infiltration would extend between flattened and distorted liver cells. (Fig. 4.) Many of the latter would show vacuoles and disintegration; occasionally intra- and intercellular pigment, with some fatty degeneration and hepatic cell destruction, rarely hyperplasia of blood capillaries and an increase in syncytial cells of Kupffer. Apparently so far as we could observe, there was no definite parallelism between the gross and qualitative liver changes and the pathologic condition of the associated abdominal condition. In some cases it was apparent that the force of the affection

was spent on the originally infected viscus, remote from the liver; in other cases the force of the offending agent apparently exerted its greatest injury

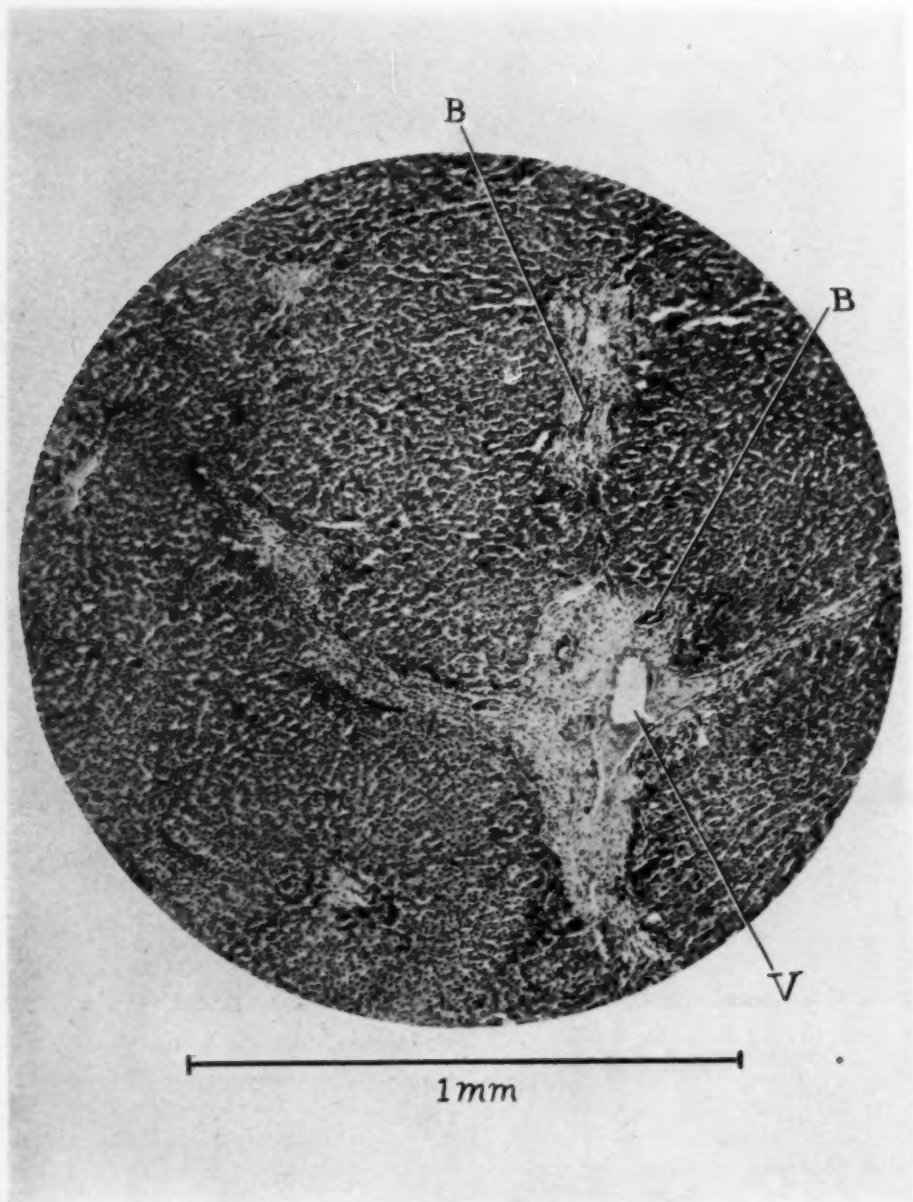


FIG. 4.—Case XVII. Section of liver, showing chronic interstitial hepatitis with conspicuous hyperplastic bile ducts. The fibrous tissue infiltrated with round cells, rich in brown pigment. (B) Bile ducts. (V) Portal branches.

on the liver with minimal changes in the extrahepatic viscus which many times was showing a well-established repair.

During the operation the histologic features of the liver could be anticipated by visible and macroscopic changes in the gross and general appearance

LIVER AND CHRONIC ABDOMINAL INFECTION

of the liver. The size of the liver, as it was viewed by the operator, was dismissed unless the apparent enlargement was so great as to call forth unusual comment. The macroscopic changes observed embraced variations in color, condition of the capsule, the presence of adhesions, retraction and

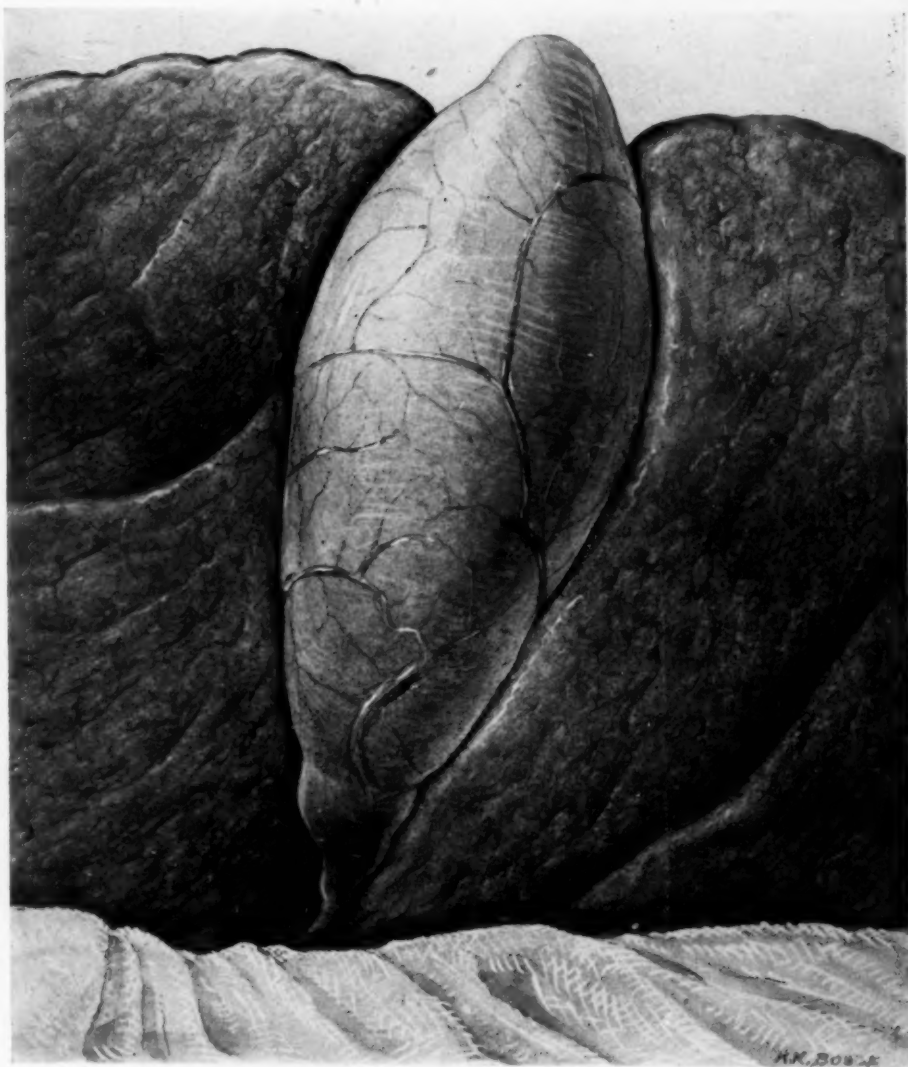


FIG. 5.—Case III. Actual drawing made at operation, showing hydrops, crenation of liver edge, dimpling of liver surfaces with area of fibrotic replacement and the marked increase in fibrous tissue trabeculae.

crenation of the edges, disposition of the fibrous elements over the superior and ventral surfaces of the liver and an intrahepatic increase in the fibrous tissue elements as evidenced in the lessened tendency for the liver to tear. The capsule of Glisson was uniformly whitened, and in many cases of such density and opacity as to prevent the recognition of the normal liver color. In about one-third of the cases there were adhesions between the liver and the anterior abdominal wall. The capsule as it extended over the edge of

the liver seemed to be retracted, giving a crenated or festooned appearance to the edge of the liver. In the area of the gall-bladder, extending laterally both internally and externally, there would be an increase in the fibrous tissue elements so that the wall of the gall-bladder would pass insensibly into a white opaque area of fibrous tissue. These fibrous tissue elements were contracted and occasionally gave a marked dimpled appearance. Less frequently the fibrous plaques would extend laterally much after the fashion of a rosette, the centre being represented by the gall-bladder. (Fig. 5.) When the gall-bladder was apparently the organ first affected, this fibrous tissue replacement reached its maximum in and about the gall-bladder. Where the stomach was involved these changes would be manifest on the left side as well as on the right side. Whether this can be taken as pointing to the lymphogenous infection of the gall-bladder and liver, and liver and gall-bladder, is capable of varied interpretation. The weight of evidence would seem to support the lymphogenous origin of gall-bladder and liver infection.

In cases showing liver changes, the color of the liver was of a marked yellow. The surface, as a rule, was not smooth but retracted and dimpled. Occasionally, the posterior and external half of the right liver would be markedly elongated into a linguiform process and would reveal an unusual degree of ductility in that there was practically no tearing of the liver tissue upon strong traction. It is my own impression, that the nearer the abdominal pathology was to the liver the more marked the changes, as the changes were most predominant in affections of the gall-bladder, and would progressively diminish with the distance away from the gall-bladder. Evidences of fibrous tissue replacement would extend toward the median line, passing over into the quadrate and caudate lobes, but stopping short at the division between the right and left lobes. On the other hand, where the abdominal infection began in areas remote from the gall-bladder, the fibrous tissue changes would appear more uniformly distributed throughout both right and left lobes of the liver.

Dr. John A. Killian studied seventeen cases for changes in the blood coincident with disease of the liver and gall-bladder. In many of these cases the non-protein nitrogen exceeded the upper normal limit of 30 mg. per 100 c.c. The urea nitrogen, on the contrary, does not show a corresponding increase, in fact, in some instances, it is subnormal. These findings would indicate a corresponding increase in the rest nitrogen. Little is known concerning the nature of the compounds constituting the rest nitrogen of the blood, but we believe an intensive study of the non-protein nitrogen partition of the blood will tell us more than we know at the present time concerning liver function. The normal blood sugar ranges from 0.90 to 0.120 per cent. In many cases of gall-bladder disease we find a mild hyperglycæmia from 0.140 to 0.200 per cent. Associated with this increased blood sugar is an increased activity of the blood diastase. It is well known that the pancreas regulates the activity of this blood enzyme and an inhibition of pancreatic function entails an abnormal diastatic activity. Apparently, then, the increased blood sugar sometimes encountered in gall-bladder disease may find its cause

LIVER AND CHRONIC ABDOMINAL INFECTION

in an associated disturbance of pancreatic function. On the other hand, in two cases we have found slight hypoglycæmias. The reason for these hypoglycæmias remains still a baffling question.

Since the liver has been regarded by some authorities as the site of formation of the fibrinogen of the blood, the fibrin content of the blood was studied in some cases. The normal fibrin content of the blood varies from 0.2 to 0.5 per cent. All of our determinations fall within the normal limits. These findings are of interest inasmuch as many of these cases manifested a delayed coagulation time. The calcium content of the blood sera of these patients was also determined. The calcium was found to be normal. This fact, however, does not contra-indicate the use of dilute solutions of calcium chloride to decrease the coagulation time because for the process of clotting ionizable calcium is essential.

OPERATIVE AND PATHOLOGIC DATA

CASE I.—F. P., Chart No. 26951, female, age twenty-seven. Operative diagnosis, cholecystitis, cholelithiasis, appendicitis, interstitial hepatitis, fibroma of uterus, pelvic peritonitis. Operation, cholecystectomy, appendectomy. Gall-bladder, color is dirty, mottled brown, with loss of olivary green; wall is thickened, contracted. No adhesions. Single calculus two cm. in diameter. Liver is enlarged ++, confined to right lobe: fibrotic areas over dorsal surface of right lobe of liver; left lobe comparatively free. Pancreas normal to palpation. Gastro-duodenal segment negative. Appendix distended, representing a mild subacute process. Remainder of abdomen negative. Sections of the gall-bladder show erosion of the rugæ over part of the surface and in other places they are thickened. The muscle coat is about four times the normal thickness and there is a very marked increase in its interstitial connective tissue. This is richly infiltrated with round cells, plasma cells and polymorphonuclear leucocytes. The outer coat is also thickened by œdema and increase of fibrous tissue. Its blood vessels are very much congested. Sections of the larger piece of liver (from right lobe) show a slight increase of connective tissue in the trabeculæ of Glisson's capsule. These trabeculæ outline the liver lobules more completely than under normal conditions. The connective tissue contains a slight excess of round cells which appear to be more intimately related to the bile ducts than to the portal branches. The liver columns are well preserved. There is a very small amount of brown pigment in the liver cells near the central vein and only very little visible fat. Sections of the smaller piece of liver (from left lobe) present a picture almost identical with that of the other piece; in fact, it has been impossible to detect any characteristic differences. Sections of the appendix show considerable inflammatory atrophy of the mucous membrane, with irregular thickening of the submucous layer in which there are dense collections of round cells, especially in the distal portion. The mucous membrane shows recent extravasations of blood. The subserous coat contains a moderate excess of round cells diffusely distributed, and it is somewhat thickened by œdema and increase of fibrous tissue. Pathological diagnosis: Chronic appendicitis; severe chronic cholecystitis, early biliary cirrhosis.†

† The descriptions of the operative findings are approximations only, and, of course, represent the personal equation of the operator. The + signs are used on a scale of four, and where denoting size may be relatively interpreted as equal to one centimetre. All of the observations are by the same operator, and although they vary from case to case in general, they represent a fair approximation. Where organs are not specified, it is assumed that they were normal.

CASE II.—B. K., Chart No. 24682, female, age fifty. Operative diagnosis, cholecystitis, subacute; cholelithiasis, diseased appendix, hepato-omental adhesions, operation, cholecystectomy, appendectomy, separation of adhesions. Gall-bladder opaque white walls, markedly thickened; no adhesions; about 150 calculi of sulphur color. Liver ++, edges fibrotic, retracted and indented. Considerable thickening of Glisson's capsule. Pancreas negative. Gastro-duodenal segment negative. Appendix, partial obliteration. Remainder of abdomen negative. The epithelium of the gall-bladder is preserved over most of the interior of the gall-bladder, but there are several points of ulceration where the epithelium is lacking and the exposed fibrous tissue is richly infiltrated with polymorphonuclear leucocytes and with large endothelial cells filled with blood pigment. The muscle bundles are slightly hypertrophied and there is moderate thickening of the interstitial connective tissue. The outer fibrous coat is also thickened. Round cells and polymorphonuclear leucocytes are present in excess throughout the entire thickness of the wall. The dense collections in the ulcerated area are purulent in character. Sections of the liver specimen show a remarkable increase of fibrous tissue near one end of the specimen. Here one sees nothing but fibrous connective tissue, blood vessels and bile ducts over a triangular area which is approximately 3 mm. in diameter. At its base this triangular area includes a few columns of liver cells. The adjacent liver tissue shows general thickening of the trabeculae of Glisson's capsule, and there is especially marked fibrous thickening about the larger bile ducts which occur in this region. One of these bile ducts is about 0.8 mm. in diameter. The fibrous tissue around it is from 3 to 5 mm. in thickness. The liver tissue near the other end of the section also shows marked increase in the thickness of the trabeculae and this connective tissue is diffusely infiltrated with round cells. In this portion the liver columns appear to be well preserved and the lobules retain their normal shape and relationships. The picture bears some resemblance to that of Laennec's cirrhosis, but the fibrosis is far advanced at one end of the section and just beginning at the other. The increase of fibrous tissue occurs about the bile ducts and blood vessels, but is distinctly more dense about the bile ducts. Apparently this specimen comes from near one of the large branches of the hepatic duct. It also includes large blood vessels. Sections of the appendix show food remnants mingled with exfoliated epithelium in the lumen. The mucous membrane shows large areas of atrophy. There is a very slight excess of round cells in the subserous coat, but the inflammation appears not to be active at the present. Pathologic diagnosis: Chronic interstitial hepatitis, and irregular cirrhosis, apparently originating about the bile ducts; chronic appendicitis; cholelithiasis and chronic cholecystitis with ulceration and severe acute purulent exacerbation of the inflammation.

CASE III.—M. N., Chart No. 24433, female, age forty-seven. Operative diagnosis, hydrops of gall-bladder, cholelithiasis, diseased appendix, hepatitis, chronic; operation, cholecystectomy, appendectomy. Gall-bladder, size of Bartlett pear; color, entire absence of green color; contains white bile; wall is markedly thickened; cystic duct obstructed; calculi, about 75 stones from 1 to 2 cm. in diameter. Liver +++++; marked Reidel's lobe, extending down to crest of ileum; dimpling on surface of liver; retraction and crenation of edge of liver; marked fibrosis. Pancreas negative. Gastro-duodenal segment negative. Appendix distended, thickened walls, considerable adhesions. Uterus and ovaries atrophied. Sections from the fundus of the gall-bladder show extensive loss of the corrugations of the mucous membrane. The muscle bundles lie very close to the thin epithelium. The entire mucous membrane is very atrophic as a result of chronic inflammation. The muscle bundles are approximately three times the normal thickness and there is an excess of round cells in the interstitial connective tissue of the muscle layer. The outer fibrous coat is thickened to a slight extent. The picture indicates a

LIVER AND CHRONIC ABDOMINAL INFECTION

most marked change in the lining mucous membrane with hypertrophy of the muscle. Sections of the gall-bladder near the neck show the mucous membrane much better preserved. Here the rugæ are somewhat irregularly thickened by increase of stroma. The muscle layer is also about three times the normal thickness and contains an excess of round cells in its interstitial connective tissue. The outer fibrous layer of the gall-bladder is moderately thickened in this region and it is diffusely infiltrated with round cells. In this portion of the gall-bladder the inflammatory reaction is diffuse and has not progressed to destruction of the mucous membrane. Sections of the piece of liver show a moderate increase in connective tissue of the trabeculæ of Glisson's capsule within the substance of the liver. In this connective tissue there are excessive numbers of round cells and in some places conspicuous small bile ducts, apparently hyperplastic. The columns of liver cells are well preserved, but among the liver cells there are some very large nuclei. The endothelial cells lining the blood sinuses are somewhat more numerous and more deeply staining than usual, and in these endothelial cells one finds an occasional mitotic division figure. In the sinuses there appears to be also slight excess of round cells and polymorphonuclear leucocytes. The round-cell infiltration in the connective-tissue trabeculæ is rather diffuse, and it is impossible to recognize that it has a closer relation to the bile ducts than the tributaries of the portal vein. The histological picture is that of a subacute interstitial hepatitis and early cirrhosis, apparently of more recent origin than the inflammation in the gall-bladder. Sections of the appendix show marked atrophy of the mucous membrane near the tip and in this region there are compact collections of round cells in the subserous coat. In the remainder of the appendix there are small areas of atrophy but no definite inflammatory infiltration. Pathologic diagnosis: Chronic appendicitis, severe chronic cholecystitis, cholelithiasis, subacute interstitial hepatitis.

CASE IV.—A. McC., Chart No. 26893, male, age forty-six. Operative diagnosis, cholecystitis, subacute; cholelithiasis; interstitial hepatitis; pancreatitis, slight; subacute appendicitis; operation, cholecystectomy, appendectomy. Gall-bladder, dirty, brown color, no green tinge; walls markedly thickened; few pericholecystic adhesions; 400 fine sulphur-colored calculi; glands along the common duct enlarged; liver +; marked fibrosis over surface of liver, particularly of right lobe of liver and adjacent to gall-bladder, with white fibrotic spots one-half cm. in diameter; color, markedly pale yellow; pancreas, abnormal hardness. Gastro-duodenal segment normal. Appendix distended, with increased thickness of the walls. Remainder of abdomen negative. Sections of the gall-bladder show extensive loss of the lining epithelium, which remains in the deeper portions of the crypts. The muscle bundles are irregularly thickened and in some places the muscle layer attains a thickness of 1 mm. There has been an enormous production of inflammatory fibrous tissue, which extends throughout the thickness of the wall. In this there are abundant round cells, polymorphonuclear leucocytes and conspicuous eosinophilic leucocytes, all of which are more abundant near the internal surface. The epithelial cells lining the deeper gland crypts are somewhat irregular in size, shape and staining qualities, but they appear to rest everywhere on a basement membrane. Sections of liver show a very definite increase of fibrous tissue in the trabeculæ of Glisson's capsule, which in many places attain a thickness of one-fifth mm. This fibrous tissue is rather dense and evidently of considerable standing. It contains an excess of round cells and very conspicuous bile ducts. The round cells appear to be closely related to the bile ducts. Branches of the portal vein and hepatic artery are not surrounded by the round cells to the same degree. The liver lobules appear smaller, as if compressed by the trabeculæ of the capsule. In many of them the

intra-lobular vein is eccentric in position. One sees also deposits of brown pigment in the liver cells adjacent to the intra-lobular vein. The hepatic cells appear otherwise normal. There is no evident excess of fat. Sections of the appendix show marked inflammatory atrophy of the mucous membrane with small deposits of blood pigment in it. The submucous layer is irregularly thickened, but the outer coats of the appendix appear negative. Pathologic diagnosis: Chronic interstitial hepatitis, evidently of biliary origin; moderately early stage of biliary cirrhosis; chronic appendicitis; severe chronic ulcerative cholecystitis; cholelithiasis.

CASE V.—J. S., Chart No. 31524, female, age forty-seven. Operative diagnosis, cholecystitis, non-calculous; hepatitis, interstitial, chronic; appendicitis, chronic; operation, cholecystectomy, appendectomy. Gall-bladder, yellow-white color; walls thickened; marked pericholecystitis; no calculi; liver ++; marked Glissonitis; moderate trabeculation of surface; crenation and retraction of edges; on palpation feels leathery; left lobe participates in the same changes as the right; the liver changes of greater intensity than pathologic changes in gall-bladder. Pancreas negative. Gastro-duodenal segment negative. Remainder of abdomen negative. Sections of the gall-bladder show well-preserved mucous membrane over most of the interior. In some places there is irregular thickening of the rugæ and in these regions the muscle bundles are hypertrophied so that the muscle layer is nearly double the thickness. There is no indication of active inflammation at the present time. The outer coat is negative. Sections of the liver show a distinct thickening of the fibrous trabeculae of Glisson's capsule and this thickening would appear to be of long standing, as there is very little evidence of round-cell infiltration. The lobules of the liver are more distinctly outlined than normal, but their cell columns are well formed and the lobules themselves are negative. Sections of the appendix show moderate inflammatory atrophy of the mucous membrane and a few extravasations of blood into it. The outer coats of the appendix appear negative. Pathologic diagnosis: Chronic, inactive appendicitis, chronic, inactive cholecystitis of mild type, chronic interstitial hepatitis, only slightly active.

CASE VI.—M. S., Chart No. 29023, female, age forty-two. Operative diagnosis, cholecystitis, non-calculous; appendicitis, chronic, with evidence of old perforation; omental adhesions; operation, cholecystectomy, appendectomy. Gall-bladder, white, contracted, fibrotic, walls thickened; no calculi; liver ++; considerable fibrosis of Glisson's capsule, more pronounced in right lobe; crenation and retraction of liver edge (repeated Widal tests for liver function negative); pancreas negative. Gastro-duodenal segment negative. Appendix, terminal two-thirds obliterated; terminal one-third ballooned out with retained material; evidently the seat of old perforation; marked periappendiceal adhesions. Numerous small fibroids. Sections of the gall-bladder show slender rugæ which are deeply stained with bile. The muscular and fibrous coats appear to be very slightly thickened by increase of connective tissue and there is, perhaps, a slight excess of round cells in the interstitial tissue of the muscle coat. There has evidently been only a slight inflammation of the gall-bladder. Sections from the right lobe of the liver show a very considerable increase of fibrous tissue in the trabeculae of Glisson's capsule. The liver lobules are quite irregular in size and some of them are evidently compressed by connective-tissue trabeculae. The fibrous tissue appears to be most dense immediately about the larger bile ducts and it contains, in some places, a marked excess of round cells. In other places it is more hyaline and contains relatively few round cells. The liver columns and the cells appear negative. Sections from the left lobe of the liver appear more nearly normal. There is, however, also a definite increase of fibrous tissue in the trabeculae about the bile ducts, although it is less marked than in the specimen from the other

LIVER AND CHRONIC ABDOMINAL INFECTION

lobe. Sections of the appendix reveal no sign of lumen nor of lining mucous membrane. The obliterating fibrous tissue contains very few small collections of round cells. It is evidently of long standing. Pathologic diagnosis: Obliterated appendix, very mild chronic cholecystitis, moderate chronic interstitial hepatitis, more marked in the specimen from the right lobe of the liver.

CASE VII.—C. K., Chart No. 25320, female, age thirty. Operative diagnosis, cholecystitis, subacute; appendicitis, subacute; hepatitis; operation, cholecystectomy, appendectomy. Gall-bladder, mottled, brown-white; walls markedly thickened; injected veins; marked hyperplasia of gland along cystic and common duct; no adhesions; no calculi; liver, right lobe ++; posterior half of right lobe shows the greatest enlargement; considerable white trabeculation over surface of liver with fibrous tissue contraction; numerous white plaques diverging from the area of the gall-bladder; consistency more leathery than normal. Sections of the gall-bladder show moderate thickening of the stroma of the rugæ and the gland crypts extend deep down into the muscle layer. The muscle bundles are approximately twice the normal thickness and the connective-tissue between them is thickened and contains an excess of round cells. There is moderate fibrous thickening of the outer coat. Some of the rugæ show a xanthomatous degeneration of the stroma. The piece of liver shows slight thickening of the trabeculæ of Glisson's capsule, in which the bile ducts are slightly more conspicuous than normal and there are collections of round cells in this tissue, apparently related to the bile ducts more closely than to the portal branches. The lobules of liver parenchyma appear negative. The lumen of the appendix contains food remnants mingled with exfoliated epithelium. The mucous membrane contains brown blood pigment and also recent extravasations of blood. It shows spots of inflammatory atrophy also. The outer coats of the appendix contain a slight excess of round cells. Pathologic diagnosis: Chronic appendicitis, chronic cholecystitis, beginning cirrhosis of the biliary type.

CASE VIII.—M. A., Chart No. 24441, female, age fifty-nine. Operative diagnosis, cholecystitis "strawberry" type, cholelithiasis, appendicitis, subacute; hepatitis, chronic; operation, appendectomy, freeing abdominal adhesions, cholecystectomy. Gall-bladder markedly inflamed; dilated blood vessels over surface; hyperplasia of gland over cystic and common ducts; wall markedly thickened; numerous adhesions to hepatic flexure and omentum; numerous small calculi; liver +; numerous adhesions on superior surface; white fibrotic areas one-half cm. in diameter; crenation and dimpling of liver surface. Pancreas abnormally hard. Gastro-duodenal segment negative except for adhesions. Appendix partially obliterated; subcaecal; numerous adhesions. Remainder of abdomen negative. Sections of the gall-bladder show thickening and partial loss of the corrugations of the mucous membrane. The muscle layer is moderately thickened and there is an excess of round cells in its interstitial connective-tissue. The outer coat appears negative. Here the most striking change appears to be in the mucous membrane and in the hypertrophied muscle bundles. Sections of the liver show a fibrous nodule, 4 mm. in diameter, embedded in the liver substance. The centre of this nodule is necrotic and disintegrated. Around the necrotic material is hyaline dense fibrous tissue in which there are irregular spaces from which lypoid material appears to have been dissolved out. There is a rather dense but irregular zone of lymphocytic infiltration walling off the fibrous nodule from the liver substance. The interpretation of this nodule is a problem which has not been solved. It may represent an area of focal necrosis, of ancient origin, or it may represent a cyst of some parasitic worm, possibly cysticercus. It has been impossible to find any elements in the cyst which will serve to identify its nature. The liver substance shows slight increase of connective-tissue in the trabeculæ of Glisson's capsule

and there is a definite increase of round cells in this connective tissue. The liver cells, themselves, contain numerous fat globules, more especially at a short distance from the central vein of the lobule. The changes in the liver, aside from the large fibrous nodule, are not very marked in this case. The obliterating fibrous tissue in the distal portion of the appendix contains a considerable number of round cells and there are dense collections of them in the thickened subserous layer in this region. In the proximal portion of the appendix, the lumen is still patent, but here there is irregular inflammatory atrophy of the mucous membrane and thickening of the submucous layer in which one finds dense collections of round cells. The subserous coat here also is thickened by increase of fibrous tissue and contains an excess of round cells. The picture indicates a rather recent exacerbation of a chronic inflammation. Pathologic diagnosis: Chronic appendicitis with evidence of a severe exacerbation, still active; chronic cholecystitis, relatively quiescent; cholelithiasis; dense fibrous nodule in liver, necrotic in its centre, possibly a parasitic cyst; slight diffuse interstitial hepatitis.

CASE IX.—A. L., Chart No. 24776, male, age fifty-one. Operative diagnosis, cholecystitis, acute, empyema; cholelithiasis; chronic appendicitis; operation, cholecystectomy, intramural enucleation of mucous membrane; appendectomy; paracentesis of liver. Gall-bladder, size of Bartlett pear, strawberry red; marked thickening of the wall, with gangrenous areas between liver and gall-bladder; marked adhesions of omentum and hepatic flexure to gall-bladder; two calculi, two and three cm. in diameter. Liver +++; oedematous; surface of liver in area of gall-bladder shows a yellow-green, mottled area, three by five cm. non-fluctuant, suggesting abscess, covered with fine granulation tissue; remaining surface of liver shows numerous white fibrotic areas, more marked on the right side. Pancreas swollen, apparently of normal consistency. Gastro-duodenal segment negative except for some hypervascularization. Appendix submesenteric, partially obliterated, with adhesions. Remainder of abdomen negative. Sections of the gall-bladder show no lining epithelium and the mucous membrane appears to have been entirely destroyed. The internal surface is covered with partly necrotic fibrino-purulent exudate. The entire wall is oedematous and infiltrated with hemorrhagic pus. The muscle bundles are moderately thickened. There are small abscesses in the wall outside the muscle coat. Sections of the liver show slight thickening of the trabeculae of Glisson's capsule and these trabeculae are everywhere richly infiltrated with round cells. These round cells appear to be somewhat more compactly grouped about the branches of the portal vein. The bile ducts are not very conspicuous. The columns of liver cells are well preserved, but they show a moderate amount of fat deposit near the central vein. Sections of the appendix show large extravasations of blood into the mucous membrane and a small amount of blood in the lumen. The hemorrhages into the mucous membrane are in part very recent, but some of them are of longer standing and the blood has already begun to disintegrate. The mucous membrane shows large areas of atrophy and there is a slight excess of round cells in the subserous coat. The picture is that of a chronic appendicitis with slight activity of the inflammatory process at the present moment. Pathologic diagnosis: Mild chronic interstitial hepatitis, apparently periportal in distribution, phlegmonous cholecystitis, supervening upon chronic inflammation, chronic appendicitis.

CASE X.—E. W., Chart No. 24895, male, age thirty-one. Operative diagnosis, appendicitis, subacute; cholecystitis, acute; operation, cholecystectomy, appendectomy. Gall-bladder markedly distended, adherent to the duodenum and transverse colon; walls thickened; hyperplasia of lymph-glands; no calculi. Liver +, considerable oedema; few white lines about gall-bladder; does not give impression of any degree of hepatitis. Pancreas negative. Gastro-duodenal segment negative.

LIVER AND CHRONIC ABDOMINAL INFECTION

Appendix swollen, turgid; lumen distended, markedly reddened. Remainder of abdomen negative. Sections of the gall-bladder show slender rugæ on the mucous membrane. There are a few spots of erosion beneath which the stroma is dense and infiltrated, with elongated wandering cells, but here the wall is only slightly thickened. The muscular coat appears normal. The connective tissue outside of it is also negative. The inflammatory infiltration in the gall-bladder is confined to the superficial portions of the internal surface, and here it occurs in small areas which appear to be ulcerated. The density of the fibrous tissue at the base of these ulcers indicates a duration of a few weeks. Section of the liver shows a slight and somewhat irregular thickening of the superficial capsule at one corner of the section. Here there is an irregular intermingling of fibrous tissue with columns of liver cells and the fibrous tissue is infiltrated with round cells. This lesion is quite local. In the remainder of the section the liver columns are well preserved and there appears to be no thickening of the trabeculae of connective tissue. The liver in general is, therefore, negative. The significance of the local fibrous thickening is quite doubtful. The mucous membrane of the appendix shows small areas of inflammatory atrophy and there is a slight excess of round cells in the subserous coat. There is no evidence of active inflammation at the present moment. Pathologic diagnosis: Chronic appendicitis, subacute cholecystitis with small ulcerations of the mucous membrane, localized scar in the liver.

CASE XI.—J. F., Chart No. 26807, male, age thirty-four. Operative diagnosis, chronic appendicitis with omental adhesions, omental sigmoidal adhesions, pancreatic fibrosis; operation, appendectomy, division of adhesions. Gall-bladder apparently normal; liver apparently normal. Pancreas presented a corrugated sensation upon palpation with hardness suggesting a moderate degree of fibrous pancreatitis. Gastro-duodenal segment is negative, except for slightly increased hypervascularization at the pylorus. Appendix is adherent to the right lateral wall, shows evidence of old periappendicitis. Remainder of abdomen, attachment of the sigmoid midpoint to anterior abdominal wall. Sections of the liver do not reveal any definite increase of fibrous tissue. The trabeculae of Glisson's capsule appear normal, except for a slight excess of round cells about the bile ducts. The columns of liver cells contain a large amount of brown pigment in fine granules, more abundant in the vicinity of the central vein. There is also a moderate excess of fat in the liver cells existing for the most part as fine globules. This liver is more nearly normal than the others which have been examined from appendix-gall-bladder cases. The obliterating fibrous tissue at the tip of the appendix contains a large amount of fat and relatively few inflammatory cells. It is evidently of long standing. Near the patent portion of the lumen, however, there are dense collections of round cells. There is moderate inflammatory atrophy of the mucous membrane in the proximal portion with corresponding fibrous thickening of the submucous layer. There is a moderate excess of round cells in the muscle layer and in the subserous coat. Pathologic diagnosis, chronic appendicitis, with partial obliteration at the tip; liver negative.

CASE XII.—A. P., Chart No. 28876, male, age seventeen. Operative diagnosis, appendicitis, chronic; tuberculous peritonitis; adenitis, mesenteric, tuberculous; operation, appendectomy; resection of tuberculous gland; lavage of peritoneal cavity with hydrogen peroxide. Gall-bladder, lost its olivary-green color; walls are thickened; otherwise negative. Liver in area of gall-bladder, number of small discrete white plaques, size of pinhead, suggesting recent inflammatory reaction or tuberculous implantations. Gastro-duodenal segment negative. Appendix rather elongated, with slight external evidence of infection. Ileocecal region, number of lymph-nodules in region of mesentery. No gross pathology in caecum itself. Sections of the first lymph-node show a fibrous capsule less than one mm.

thick surrounding the partly calcified caseous material. Remnants of lymphoid tissue are seen in the capsule and in some places there are groups of epithelioid cells with an occasional Langhans' giant cell. Increase of the fibrous tissue has almost obliterated the evidence of tuberculosis and the picture is that of a nearly healed tuberculous process. Sections of the second lymph-node show an increase of fibrous stroma and endothelial elements, but tubercles are not recognized. Sections of the liver show slight irregular thickening of the external capsule and a moderate increase in fibrous tissue in the internal trabeculae. In the latter there is a moderate excess of round cells and small bile ducts are fairly conspicuous. Tubercles are not recognized. The lumen of the appendix contains food remnants. There is considerable inflammatory atrophy of the mucous membrane and scattered deposits of brown blood pigment in it. The outer coats of the appendix appear negative. Tubercles are not recognized in the appendix. Pathologic diagnosis: Chronic appendicitis, calcified mesenteric lymph-node showing partially healed tuberculous process, slight interstitial hepatitis of uncertain causation.

CASE XIII.—J. G., Chart No. 25690, male, age twenty-six. Operative diagnosis, appendicitis, acute; operation, appendectomy. Gall-bladder, white, opaque color; walls slightly thickened. Liver presents a diffuse white mottled appearance. Pancreas is negative. Gastro-duodenal segment negative. Appendix is nine cm. long, two cm. in diameter, filled with fecal material, suggesting a hyperplastic tuberculous appendix. Remainder of abdomen negative. Sections of the liver show a distinct but moderate thickening of the fibrous trabeculae of Glisson's capsule. In the fibrous tissue are moderately numerous wandering cells which are elongated in the spaces between the fibres. These wandering cells are slightly more abundant about the bile ducts than elsewhere. The liver lobules are somewhat irregular in size and shape and in some places the columns appear to be pressed together. The picture is that of a somewhat irregular cirrhosis of an early stage, evidently of the biliary type. Sections of the appendix show recent extravasations of blood into the mucous membrane. The entire thickness of the wall is oedematous and infiltrated with round cells and polymorphonuclear leucocytes. The subserous coat is greatly thickened and show fibroblastic proliferation, as well as large numbers of wandering cells. The picture is that of a severe purulent appendicitis of several days' duration. Pathologic diagnosis: Severe subacute purulent appendicitis, early biliary cirrhosis of liver.

CASE XIV.—J. G., Chart No. 28512, female, age twenty-two. Operative diagnosis, subacute appendicitis, chronic cholecystitis, non-calculous; operation, appendectomy, cholecystectomy. Gall-bladder small, contracted, absence of green color; considerable thickening of walls; papillomatous appearance of mucous membrane. Liver ++; confined to right side; numerous plaques over the superior surface of the liver. Pancreas negative. Gastro-duodenal segment negative. Appendix seven cm. in length, bulbous extremity; numerous adhesions. Remainder of abdomen, moderate visceroptosis. Sections of the gall-bladder show slight thickening of the stroma of the rugae. The muscle coat is also slightly thickened and there is a marked excess of round cells and polymorphonuclear leucocytes in its interstitial connective tissue. This inflammatory infiltration extends only a short distance into the outer connective-tissue coat. The inflammation of the gall-bladder is moderate in degree and duration. Sections of the liver show a moderate thickening of the trabeculae of Glisson's capsule and the fibrous tissue appears to be more dense about the larger bile ducts than elsewhere. In some places this fibrous tissue is hyaline with only a few round cells in it. In other regions there is less fibrosis and a very marked excess of round cells. The liver columns stain somewhat irregularly and in the central portion of the lobule they contain brown pigment. There does not appear to be any excess of fat, however; the lumen of

LIVER AND CHRONIC ABDOMINAL INFECTION

the appendix contains a small amount of exfoliated epithelium. The mucous membrane appears well preserved. There is, however, irregular thickening of the submucous layer and occasional dense collections of round cells in it. The subserous coat is also rather richly infiltrated with round cells and there are collections of plasma cells in some places. Round-cell infiltration is also present in the muscle layer. Pathologic diagnosis, chronic appendicitis, with evidence of a fairly recent severe attack; subacute cholecystitis; interstitial hepatitis of very moderate grade, showing evidences of exacerbation from time to time.

CASE XV.—H. F., Chart No. 25128, female, age twenty-four. Operative diagnosis, chronic appendicitis, cæcum mobile, mild hepatitis, chronic cholecystitis; operation, appendectomy, cæcoplication. Gall-bladder, walls slightly thickened, otherwise negative, except for more than normal vascularization. Liver, thin edge, with enlargement of the right lobe; uniformly distributed over the upper portion numerous white patches strongly suggestive of chronic hepatitis. Pancreas negative. Gastro-duodenal segment negative. Appendix infantile in type, contains fecoliths; considerable congestion. Remainder of abdomen, moderate degree of visceroptosis. Sections of the liver show considerable thickening of the trabeculæ of Glisson's capsule and in this thickened fibrous tissue the bile ducts are rather conspicuous. The fibrous tissue is dense and hyaline and contains only a moderate excess of round cells. The columns of liver cells appear to be well preserved. There is only a moderate amount of brown pigment in these cells. The picture resembles that of an early stage of biliary cirrhosis, but the hyaline character of the trabeculæ shows that the process has already existed for many months. The lumen of the appendix contains food remnants. The mucous membrane shows large spots of inflammatory atrophy and in some places there is a large amount of brown hæmatogenous pigment between the gland crypts, most of it contained within phagocytic cells. There is a slight excess of round cells in the subserous coat. Pathologic diagnosis: Moderate biliary cirrhosis, chronic appendicitis.

CASE XVI.—K. H., Chart No. 27361, male, age forty-three. Operative diagnosis, ulcer, pyloric, superior; chronic appendicitis; operation, posterior gastro-enterostomy, appendectomy. Gall-bladder surgically negative. Liver negative. Gastro-duodenal segment, just proximal to the pylorus on the superior curvature of the stomach, subacute ulcer of the stomach with hypervascularization, stippling and infiltration. Appendix, moderate degree of inflammatory change. Sections of the liver show a very slight increase in the connective tissue of the trabeculæ of Glisson's capsule, possibly not more than would be normal for the age forty-three. There is, however, a moderate excess of round cells in these trabeculæ, very abundant in some places. These round cells appear to be closely related to the bile ducts, especially the smaller bile ducts. The larger bile ducts show fibrous thickening of their walls with a slight excess of round cells. The columns of liver cells are well preserved and contain a large amount of brown pigment in the central zone of the lobule. Sections of the appendix show the lumen to be obliterated at the tip. The obliterating fibrous tissue contains a moderate number of round cells and would appear to be of fairly recent origin. In the proximal portion of the appendix the mucous membrane is fairly well preserved. The outer coats of the appendix contain an excess of round cells in the distal portion. Pathologic diagnosis, subacute interstitial hepatitis of mild grade, apparently a very early stage of biliary cirrhosis; chronic appendicitis with fairly recent obliteration at the tip.

CASE XVII.—I. C., Chart No. 25647, male, age fifty-three. Operative diagnosis, ulcer, pyloric; pyloric obstruction; diseased appendix; operation, gastro-enterostomy, posterior; appendectomy. Gall-bladder negative. Liver, mild degree

of yellow-white mottling. Gastro-duodenal segment, a prepyloric infiltrating annular tumor extending backward toward the head of the pancreas, with considerable secondary enlargement of the duodenal section of pancreas. Gastric wall markedly hypertrophied; pylorus about 75 per cent. obstructed; no evidence of glandular involvement. Appendix about seven inches in length, infantile in type; partially obliterated. Remainder of abdomen negative. Sections of the liver specimen show a very marked fibrous thickening of the external capsule, especially in the vicinity of the small depression in it. The fibrous tissue here is extensively infiltrated with round cells and there are numerous irregular bile ducts running through the fibrous tissue. The adjacent liver lobules are considerably distorted and the fibrous trabeculae of the capsule, extending into the liver substance, are considerably thickened and infiltrated with round cells. The bile ducts appear to be hyperplastic and are very conspicuous in the trabeculae. The central veins of the lobules are surrounded by liver cells rich in brown pigment. There is also a considerable hyperplasia of the endothelial lining and of the fibrillar connective tissue of the central veins. Sections of the appendix show food remnants in the lumen and the mucous membrane contains deposits of brown blood pigment and also small recent hemorrhages. It is in part atrophic. The submucous layer contains a few compact collections of round cells. There is also an excess of round cells in the muscle coat and in the subserous layer. Pathologic diagnosis, chronic appendicitis, chronic interstitial hepatitis, apparently closely related to the bile ducts.

CASE XVIII.—A. A., Chart No. 28874, male, age sixty-five. Operative diagnosis, carcinoma, gastric, secondary to old ulcer of lesser curvature, midportion; ascites; operation, exploratory laparotomy. Gall-bladder negative. Liver ++; enlarged. No evidence of metastasis on surface. Numerous metastases on central fissure. Gastro-duodenal segment, anterior surface of stomach, chronic, calloused ulcer 3 cm. from the lesser curvature, occupying midposition in the stomach; extending in all directions an infiltrating carcinoma. Glandular involvement along greater and lesser curvature with extension downward through gastro-colic omentum. Appendix undisturbed. Remainder of abdomen, general carcinomatosis. Sections of the liver show irregular thickening of the external capsule and a moderate thickening of the fibrous trabeculae in the interior of the liver. Neoplasm is not found in the liver section. Sections of the first specimen show adipose tissue containing a lymph-node. In the adipose tissue, as well as in the lymph-node itself, are irregular small nests and small alveoli of epithelial cells. These cells have a rather pale cytoplasm. Their nuclei are irregular in size and shape, but in general are large in proportion to the size of the cells. Mitotic division figures are present in small numbers. The site of the primary tumor cannot be recognized, but the appearance suggests the gastro-intestinal tract as its site. Pathologic diagnosis, secondary adeno-carcinoma of stomach, inoperable; mild chronic interstitial hepatitis.

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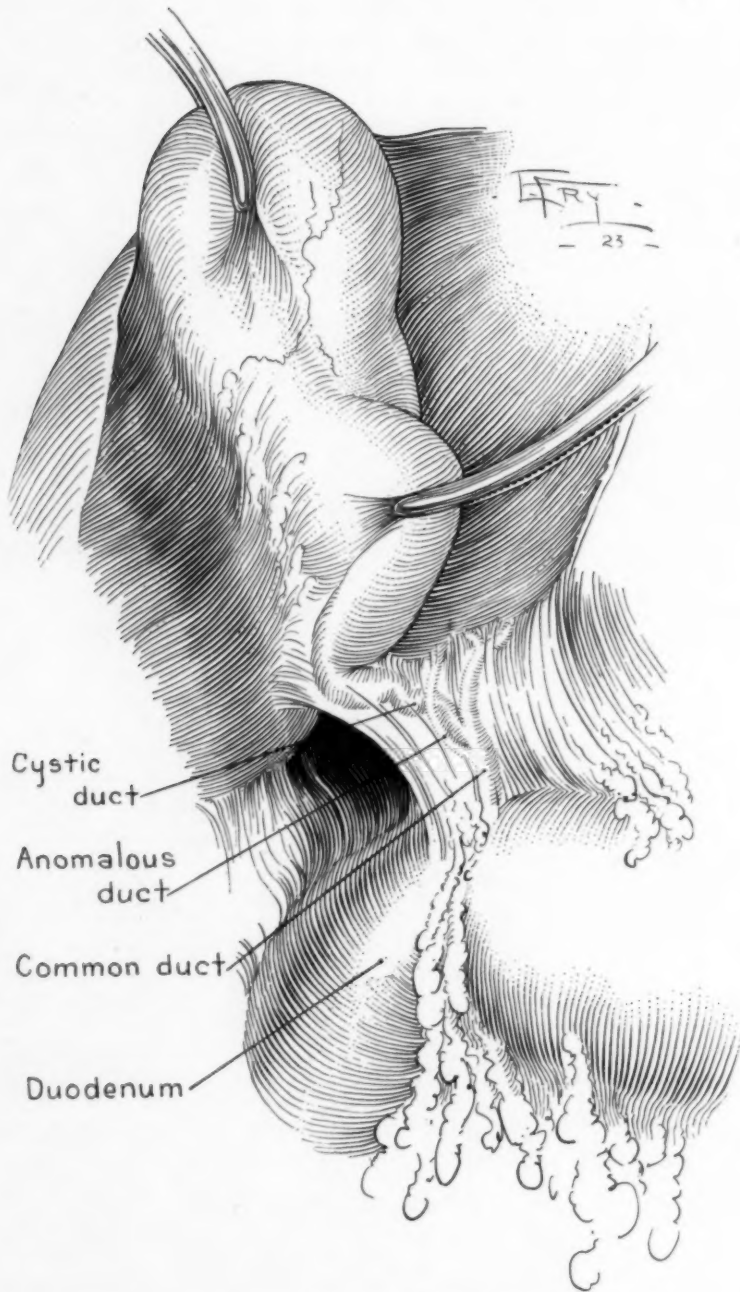


FIG. 1.—Anomalous hepatic duct.

A METHOD OF RECONSTRUCTING AN ANOMALOUS HEPATIC DUCT INJURED AT OPERATION

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BECAUSE of the danger of injuring anomalous hepatic ducts during removal of the gall-bladder, the method is described which was used recently by C. H. Mayo of anastomosing the stump of the cystic duct to the cut end of an anomalous branch of the hepatic duct, which was injured when the gall-bladder was removed. If, in performing cholecystectomy, the method is used in which the cystic duct is first exposed and its union with the common

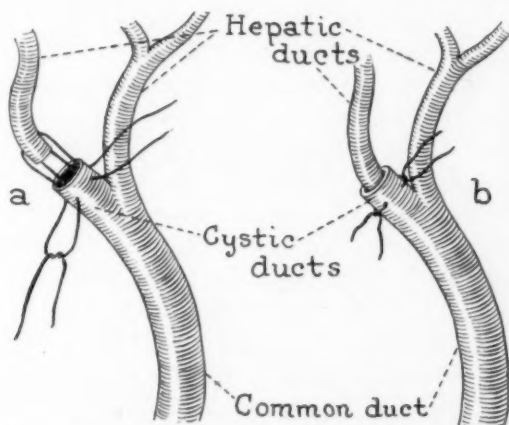


FIG. 2.—a. Sutures placed but not tightened. b. Hepatic duct telescoped into cystic duct and sutures tied.

duct visualized, there is little danger of injuring a normal common or hepatic duct, unless there are small anomalous branches (Fig. 1), in which case the anomalous duct may be severed with the cystic duct because of its proximity. Immediate recognition in this case made it possible to make the anastomosis. Sutures were introduced opposite each other into the stumps of the cystic and anomalous hepatic duct, as shown in Fig. 2a, so that when the sutures were tied, the hepatic duct was telescoped into the remnant of the cystic duct (Fig. 2b). A small portion of omentum was drawn up and placed in the liver notch, and two Penrose drains inserted in apposition, reaching down to the anastomosis. A small amount of bile drained from the wound for a few days; it then diminished gradually and the stools took on their normal brown color. The patient convalesced uneventfully.

RUPTURE OF THE SPLEEN

REPORT OF TWENTY CASES OBSERVED IN CHINA

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SURGEON TO ST. LUKE'S HOSPITAL

THAT rupture of the spleen is a frequent occurrence in the Orient is a common belief. We have considerable confirmatory information on the subject so far as India is concerned, but as yet little has been written on ruptured spleens in China. I reported two cases in the *China Medical Journal* in the January issue of 1917. I would like now to report twenty additional cases, all were treated in St. Luke's Hospital, Shanghai, on my own surgical service and the service of Dr. A. W. Tucker, who has kindly allowed me to report his cases.

While a number of writers have reported cases of spontaneous rupture of the spleen, it is interesting to note that all of our cases follow injuries. Not in my own experience nor in the experience of a number of my colleagues has spontaneous rupture been diagnosed. Such an accident must be rare, even in the most malarial districts of China. Many of the Chinese, for one reason or another, have very large spleens, and yet five of the most active surgeons in five different sections of China outside of Shanghai report, in answer to a questionnaire, that they have not seen a single case of rupture of the spleen, either accidental or spontaneous. All of these surgeons were working away from seaports. Price, of the Chinese Hospital, Shanghai, reported three ruptures during the past three years. It has occurred to the writer that possibly something about the work of the laborers in the seaports had to do with the increasing frequency in Shanghai. Does rupture of the spleen, even in countries where large spleens are common, only occur frequently where modern industry prevails? Answers to my questionnaire and my own experience would tend to confirm that belief.

In studying the etiology of our cases we find that 30 per cent. were caused by tram or motor car accidents—instruments of slaughter not found in the interior of China.

To our surprise 50 per cent. were the result of assault and battery. Why such encounters should prove so much more disastrous in Shanghai than up-country I can not explain, unless it be due to the fact that Shanghai is a cosmopolitan centre where personal combats are more frequently provoked and more fiercely contested.

Age.—All of our cases were young, the oldest was thirty-nine and the youngest was ten, the average being twenty-four years. This is about the average age of patients admitted to St. Luke's Hospital and is the age most exposed to hazardous occupations.

RUPTURE OF THE SPLEEN

Symptoms.—I have been surprised to find such a large number of our cases—50 per cent.—became unconscious at the time of the accident and remained so from a few minutes to several hours; this symptom is so frequently found that I consider it to be helpful in the making of a diagnosis. "Pain radiating to the left shoulder" is mentioned by a number of writers on this subject, but has not been recorded in any of our cases, although definitely sought for in the last few. Pain and tenderness over the left side were found to be, in our cases, the two most constant symptoms.

Diagnosis from other abdominal injuries is frequently very difficult. In one of our cases the marks of injury and the most prominent symptoms were all over the right side and this case was diagnosed as rupture of the liver. A right rectus incision was made. The liver was found to be uninjured but the spleen crushed. Fortunately the pedicle was long enough for the injured organ to be removed through the original incision.

Pathology.—In all cases operated on the spleen was found to be enlarged, in some instances to three or four times the normal size. In two the malaria plasmodium was discovered. History of previous attacks of malaria was given in a large percentage of cases.

Treatment, Operative.—With our early cases the practice was to operate upon all, immediately it was decided that we were dealing with rupture of the spleen, provided, of course, that the consent of the patient or parents could be secured. Two or three of those who refused operation recovered, and we were forced to believe that it was possible for certain cases of rupture of the spleen to recover without operation. In later years certain cases presenting much shock have been allowed to rest before operating upon them. Others with symptoms not so pronounced but still those of rupture of the spleen have been treated without any operation. Our practice now is instead of operating on all cases just as soon as a diagnosis is made, each case is treated individually and the amount of shock and the condition of the blood and of the patient determines our line of treatment, whether to operate immediately, postpone operation until reaction from shock, or not to operate at all.

Non-operative.—Whenever it is decided that a case is too much under shock for immediate operation, he is put to bed with blankets and hot water bottles, given a hypodermic of one-quarter morphine and warm saline solution by the Murphy drip method is begun and just as soon as the condition of the patient will permit, he is put up in the Fowler position. Morphine helps to keep the patient quiet and lessens peristalsis; the Murphy drip supplies the body with additional liquid while the Fowler position causes the free blood to gravitate to the pelvis, where it will give the least trouble. That position is also desirable because of the possibility of other organs having been injured.

Results Obtained.—One patient refused operation and was removed from the hospital before any treatment was given. Of the nineteen remaining for treatment, 58 per cent. recovered and 42 per cent. died. Of the fatal cases only five had been operated upon. Two of these died on the operating table; one within twenty-four hours; one on the fifth day after operation, probably

from embolus, and one at the end of two weeks from general peritonitis. It is interesting to note that most of these fatal cases were those having been injured by tram car or automobile accidents, or by a fall from the second or third floor.

Of the ten cases resulting from assault and battery, 80 per cent. recovered; those resulting from tram car or automobile injuries, 50 per cent. recovered; those due to fall, 100 per cent. died; and one hit by an oar also died.

In reviewing our cases, I feel that with our first cases we operated when the condition of the patient was such as to make it almost a certainty that he would die. I believe now that a more careful consideration of the condition of shock would have caused us to be more cautious about immediate operation. One of our cases, Case XVI, came into the hospital and was given treatment and allowed to go away to be brought the next day in a dying condition. In one other case operation was probably postponed too long for the good of the patient. While a patient is under observation he should be nursed by a special nurse, his pulse recorded at least once an hour, the hæmoglobin estimated and blood-pressure taken frequently, and abdomen frequently palpated and percussed to elicit any changes there. With a decreasing hæmoglobin and blood-pressure and increasing thirst, with or without appearance of dulness in the flanks, operation should be strongly advised.

CASE I.—S. K. S., age twenty-three. Hospital No. 2424. Admitted to St. Luke's Hospital, November 3, 1917.

Social and Past History.—Unobtainable.

Present Illness.—The patient was run over by a motor car and was immediately brought to St. Luke's Hospital. He gave symptoms of internal hemorrhage with considerable shock. Immediate operation was advised.

Under general anæsthetic the abdomen was opened by a left rectus abdominal incision. Upon opening the peritoneum a large amount of free blood gushed out. The spleen was found to be ruptured transversely. The pedicle was clamped and normal saline solution immediately given intravenously. Spleen was removed and the patient died on the table.

CASE II.—T. A. H., age unknown. Hospital No. 2468. Admitted to St. Luke's Hospital, November 10, 1917.

Past History.—Two weeks before admission to the hospital the patient fell down stairs, but was able to resume his work the following day.

Present Illness.—One hour before admission to St. Luke's Hospital he was run over by a motor car which crushed the costal margin.

Examination on Admission.—The patient was in great shock. There was numbness and coldness over the body, slight pain over the splenic region. A diagnosis of ruptured spleen was made, and operation advised, which was refused by the mother and wife. Five hundred c.c. of normal saline solution were given intravenously and 2000 by the rectum and the patient treated for shock.

The patient died at 5 A.M. next morning.

CASE III.—L. Y. S., age ten years. Hospital No. 3727. Admitted to St. Luke's Hospital, July 6, 1918.

Family, Social and Past History.—Unknown.

Present Illness.—On the day of admission the patient fell down from a verandah

RUPTURE OF THE SPLEEN

on the second floor. He was unconscious for three or four minutes. Immediately after return to consciousness he complained of abdominal pain.

Examination on Admission.—Patient is pale, he has a gash on the right forehead, but no sign of depression. Patient was conscious and answered rationally. Pupils react to light and accommodation. Restlessness and thirst were his chief complaints. The abdomen was rigid and tense. Pain was most intensive on left side and around the umbilicus. Percussion gave tympany on the surface and dullness in the flanks of the abdomen, especially on the left side. A diagnosis was made of internal hemorrhage with, very probably, rupture of the spleen. His pulse ran as high as 160 per minute and was very small. Operation was advised but refused by the family.

The child was taken home against advice.

CASE IV.—I. K. P., age thirty. Boatman. Hospital No. 4901. Admitted to St. Luke's Hospital, January 14, 1919.

Present Illness.—On the day of admission while standing in his sampan his boat was struck by another sampan which caused him to fall, striking his left side on the side of the boat. He was unconscious for a short time and was immediately carried to St. Luke's Hospital.

Physical Examination.—Severe shock and only semi-conscious, pupils fully dilated and not reactive to light. His lips and conjunctivæ were anæmic. Pulse was rapid and weak. Palpation of abdomen found tenderness and rigidity on left side. The patient was put to bed with hot water bottles to react from the shocked condition. He reacted somewhat, but became more restless and the pulse more rapid and weaker and operation was advised and accepted.

Under ether and through a left rectus incision the abdomen was opened and the peritoneal cavity found to be full of free blood. The spleen was not very large and was ruptured in a number of places. The left kidney was loosened but not injured. Exploration of the abdomen revealed no other organ injured. The spleen was removed and the abdomen closed without drainage and the patient left the operating table in fair condition.

The next day the urine was tinged with blood, the general condition of the patient was fair, hæmoglobin 50 per cent. The patient improved for five days and was apparently in quite satisfactory condition at 10 P.M. on the fifth day. Early next morning he was found by the nurse in a dying condition and died before an interne could reach him.

No post-mortem was obtainable and the cause of death was thought due probably to embolism.

CASE V.—Z. W. Z., age fourteen. Hospital No. 6187. Admitted to St. Luke's Hospital, August 13, 1919.

Family, Social and Past History.—Not obtainable.

Present Illness.—On the day of admission the patient jumped from a tram car and fell in front of an automobile, which was supposed to have run over him. He was immediately brought to St. Luke's Hospital in very poor condition.

Examination on Admission.—The patient was found to be very anæmic, extremities cold and covered with perspiration, the pulse was weak and rapid, respiration rapid and laborious, and percussion revealed dullness all over the abdomen.

The patient was put to bed in blankets and with hot water bottles and an ice bag applied to the abdomen. While waiting for operation the patient spat up a few drops of blood. The condition improved but little and at 7.30 P.M., under an ether anæsthetic, the abdomen was opened by median incision and the peritoneal cavity found to be full of free blood. The spleen was crushed into six pieces, the pedicle was clamped and vessels ligated. The spleen was removed. Exploration of the abdomen revealed no other injured or bleeding parts. The blood was removed from the peritoneal cavity and the abdomen filled with warm saline solution and closed.

Artificial respiration was performed but without good results. At each time that air was expressed from respiratory cavity, blood was forced from the nostrils. Cause of death was thought to be due to hemorrhage and shock.

CASE VI.—L. F. P., age thirty-nine. Hospital No. 7989. Admitted to St. Luke's Hospital, May 23, 1920.

Social History.—Drinks and smokes moderately, denies specific disease.

Past History.—Has had no malaria or typhoid.

Present Illness.—At 2.30 P.M. the day of admission patient was assaulted and struck over the splenic area, which caused abdominal pain on the right side. He was taken to his home and put to bed, but his color changed, and his pain grew worse so that he was brought to the hospital.

Physical Examination on Admission.—Patient looks weak, anæmic and exhausted, respiration hurried and slow. The pulse is weak and rapid, 112 per minute. Palpation shows rigidity and percussion, slight dulness over the splenic region. The hæmoglobin was 70 per cent.

The patient was put to bed and prepared for operation and eight and one-half hours after accident he was given a general anæsthetic and the abdomen opened by a left rectus incision through the upper abdomen. Upon opening the peritoneal cavity considerable blood gushed out. Exploration found the spleen to be ruptured, the pedicle was clamped and ligated with silk. The spleen was removed and the abdomen flushed out with warm saline solution and closed without drainage. The patient left the operating room in a bad condition. Two pints of warm saline solution were given intravenously. The next morning the patient complained of great thirst, pulse was good, 108 per minute, no sign of distention, and only slight pain in the wound. The next day after the operation the hæmoglobin was 55 per cent., the white blood-cells 18,500, red blood-cells 4,800,000, lymphocytes 19 per cent., neutrophils 73. On the following day the hæmoglobin was 52 per cent., twelve days after the operation hæmoglobin was 58 per cent., white blood-cells 22,000 and the red blood-cells 4,400,000. No parasites were found in the blood. The stitches were all removed on the eighth day and the wound was clean and dry.

The patient made uneventful recovery, leaving the hospital on the twenty-fifth day in good health.

CASE VII.—L. K. N., age twelve. Hospital No. 8230. Admitted to St. Luke's Hospital, July 2, 1920.

Family, Social and Past History.—Unimportant.

Present Illness.—Just before admission to the hospital, while running across the street, the patient was struck by a motor car and knocked down. The wheel of the car struck his head, but did not go over the body.

Physical Examination on Admission.—There were abrasions around the head but no serious head injury. Pulse a little quick but strong. No rigidity or tenderness over the abdomen.

The patient was put to bed for observation. At 7 P.M., a few hours after admission, the patient was found to be very anæmic and perspiring profusely. Pulse was rapid and small and there was dulness over the right side but none over the left. He complained of pain in the abdomen. By 10.30 P.M. his hæmoglobin was 75 per cent. and the systolic blood-pressure 70 per cent. A diagnosis of internal hemorrhage with probable rupture of the liver was made and operation advised.

Under ether anæsthetic the abdomen was opened by a right rectus incision and much dark blood was found in the peritoneal cavity. The right side was first explored but no bleeding point found. The liver was uninjured. Upon examination the left side of spleen was found to be badly lacerated, one part being entirely separated. The pedicle was clamped, ligated, and the spleen removed. After flushing out the abdominal cavity with saline solution, the wound was closed by interrupted sutures.

RUPTURE OF THE SPLEEN

The patient made an uneventful recovery, except on the fourteenth day when he began to have an attack of malaria.

Pathological report on the spleen showed chronic fibrosis, congestion and hyperplasia of malpighian bodies.

CASE VIII.—W. L. P., age thirty-five. Hospital No. 8461. Admitted to St. Luke's Hospital, August 1, 1920.

Family, Social and Past History.—Negative.

Present Illness.—Some days before admission a man with his fists struck the patient over the abdomen, causing some pain in that region. The patient recovered in a day or so. On the day of admission he again felt pain in the abdomen, especially on coughing.

Physical Examination on Admission.—The patient was anæmic and exhausted. Pulse was feeble and rapid. There was dullness in the flanks on both sides. Immediate operation was advised and consented to.

Under ether anæsthetic the abdomen was opened by a left rectus incision. On opening the abdomen considerable free blood was found. The left side was explored and the spleen found to be ruptured. A splenectomy was performed and the patient made an uneventful recovery, leaving the hospital on the nineteenth day.

CASE IX.—S. V. K., age thirty-seven. Bean curd seller. Hospital No. 8987. Admitted to St. Luke's Hospital, October 8, 1920.

Family, Social and Past History.—Unimportant.

Present Illness.—On the night before admission the patient was tossed up by a number of his enemies and thrown flat on the ground, landing on his back. This performance was repeated until the patient was unconscious. He was immediately taken home, after which he regained consciousness. He felt pain all over the abdomen. He said that during the bumps he at first felt very dizzy and saw many flashes of light. He had intense pain during the night with fever and profuse sweating.

Physical Examination on Admission.—Lips and conjunctiva pale; pulse rapid, 116 per minute; tenderness over entire abdomen, but more marked over left side. Hæmoglobin 38 per cent., red blood-cells 2,860,000.

Patient was put to bed and given morphia and Murphy drip. He gradually regained his color and strength and left the hospital on the thirteenth day, apparently well.

CASE X.—Unknown, age unknown. Hospital No. 9942. Admitted to St. Luke's Hospital, March 30, 1921.

Family, Social and Past History.—Not obtainable.

Present Illness.—About one hour before admission patient fell from a three-story window and was brought to the hospital in an unconscious condition.

Physical Examination.—Face very pale and distressed; pulse wiry, weak and rapid. There was general tenderness over the entire abdomen, especially the splenic area.

At 8.30 P.M. an exploratory laparotomy was performed. On opening the peritoneum the abdomen was found full of blood and the spleen ruptured. Splenectomy was done and 600 c.c. saline solution was given intravenously. The patient left the table in very poor condition. He was put to bed and Murphy drip ordered. He did not rally and expired at 1.30 A.M.

CASE XI.—L. K. K., age fifteen. Hospital No. 10251. Admitted to St. Luke's Hospital, May 17, 1921.

Family History.—Unimportant.

Social and Past History.—Negative.

Present Illness.—At 8 A.M. on the day of admission, while quarrelling with a riksha coolie, patient received a blow on his abdomen in the left hypochondriac region. The patient fell down and immediately became unconscious.

J. C. McCracken

Physical Examination on Admission.—Patient is pale and anæmic, pupils are equal and reactive. On palpation the abdomen is rigid and tender, especially on the left side. Percussion gives a dull note in the flanks. On auscultation no gurgling sounds are heard over the left hypochondrium. The pulse is rapid and feeble. Operation was advised and permission secured. Operation begun at 9.30 A.M. A six-inch incision was made through the right rectus muscle. Large amount of free blood found in the abdominal cavity. The spleen had a small rupture on the inner surface, bleeding had already ceased. No rupture of liver, intestines or kidneys was found. Since bleeding had already ceased the abdominal wall was closed by interrupted sutures without removal of the spleen. Two days later the patient complained of difficulty in urination and dulness was found over the suprapubic region.

On the third day after operation patient vomited once, had a fecal odor. Abdomen is distended and tender, more marked over the right upper hypochondrium. Peritonitis was suspected and operation advised.

Under general anæsthetic the abdomen was opened by a straight incision in right lower quadrant. Considerable pinkish-colored discharge was found which had no odor of feces or urine. Two rubber tubes were inserted for drainage. The patient left the table in bad condition and died four days later from general peritonitis.

CASE XII.—C. K. S., age twenty-four. Hospital No. 11271. Admitted to St. Luke's Hospital, October 2, 1921.

Past History.—Had malaria at sixteen years of age. No other history of importance.

Present Illness.—On the day of admission, at about 10 A.M., while the patient was pushing a wagon, a tram car knocked him down, the handle of the car striking the patient in the abdomen. The patient immediately became unconscious, but returned to consciousness after a very short time.

Physical Examination on Admission.—Pulse weak and rapid, abdomen tender all over. Slight muscular rigidity. Abdomen was not distended and there was no dulness in the flanks. The patient was put to bed with hot water bottles and two grains of camphor ordered, given fourth hourly.

The next day the patient's color was not returning, pulse very weak, abdomen distended and dulness found in the flanks, very tender to touch, especially over the right iliac region. Breathing not much quickened but costal in type. There was no vomiting and no blood present in the stools, peristalsis still present. The rupture of the bowel was suspected. Hæmoglobin 55 per cent., white blood-cells 16,000. Patient was immediately prepared for exploratory operation. Under a general anæsthetic an incision was made through the right rectus. Upon opening the peritoneum the abdominal cavity was found to be full of dark bloody fluid. The hepatic region was first explored and the liver found to be normal. The intestines were delivered and a search made for rupture. No injury found. On palpating the spleen it was found to be enlarged and a rupture running across the surface palpated. The pedicle was grasped in the hand of the operator while his assistant made another incision on the left side. The spleen was removed and the abdomen closed as usual. The patient left the operating table in bad condition. He was put to bed and the Murphy drip begun.

The following day the pulse was much improved and the general condition of the patient satisfactory. On the following day the hæmoglobin was 60 per cent., white blood-cells 15,000. On the morning of the seventh day, after a very severe coughing spell, the dressing was found to be soaked with sanguineous fluid. On examination the silk-wrought stitch was found to be broken and the wound gaping.

The patient made an uneventful recovery, the stitches all being removed two weeks after the operation. On the following day the patient had a severe chill

RUPTURE OF THE SPLEEN

followed by a high temperature. Blood examination showed hæmoglobin 65 per cent. and the presence of tertian malaria parasites. Laboratory report of ruptured spleen showed fibrosis and hemorrhage in the splenic tissue. The patient left the hospital on the fortieth day.

CASE XIII.—Z. A. P., age twenty-nine. Hospital No. 11471. Admitted to St. Luke's Hospital, November 2, 1921.

Family, Social and Past History.—Negative.

Present Illness.—At 7 A.M. in the morning on the day of admission, while quarrelling with others, the patient received a blow over the lower portion of the left side of the chest. Immediately he fell to the ground and was unconscious for about half an hour. When he returned to consciousness he felt keen pain in the abdomen which continued until after admission, and morphia was given. Upon admission he spat up a small amount of blood.

Physical Examination.—Face and lips very anæmic, pulse weak but not rapid, 72 per minute. Abdomen shows some rigidity and slight tenderness over the splenic region, abdominal respiration present. No dulness in the flanks on percussion. He had a bruise area extending from the fifth rib to the costal margin on the left side. The spleen was not enlarged. The patient was put to bed in blankets and hot water bottles with a hypodermic of $\frac{1}{4}$ morphine.

In the afternoon the patient appeared to be better, the pulse improved. Next day there was still evidence of improvement with less tenderness over the splenic area. In the afternoon the patient complained of distention and pain in the abdomen and was quite restless. Examination of the abdomen showed slight distention, more over the left quadrant with increasing rigidity of the abdominal wall. No dulness could be percussed in the flanks and the pulse remained fair. The patient was put up in the Fowler position, $\frac{1}{4}$ grain of morphine and 1/100 grain of atropine given hypodermically and turpentine stoops applied to the abdomen. The patient had a fairly comfortable night, but felt fulness in the abdomen on the following day.

The blood examination on the day after admission found 65 per cent. hæmoglobin, 4,356,000 red blood-cells and no malarial parasites.

Ten days after admission hæmoglobin was 55 per cent., white blood-cells 14,000 and red blood-cells 2,168,000.

The patient continued to improve and left the hospital in good condition three weeks after admission.

CASE XIV.—W. S., age twenty-two. Hospital No. 11562. Admitted to St. Luke's Hospital, March 18, 1921.

Family, Social and Past History.—Negative.

Present Illness.—Just before admission, while in a fight, patient received two blows which struck against his hypochondriac region. He immediately felt pain all over the abdomen, but no nausea and no vomiting and only slight distention.

Examination on Admission.—Abdomen shows slight distention over epigastric region. Abdominal respiration present but not marked. Abdominal rigidity palpable more over the left upper quadrant of abdomen. Tenderness found over the same region, percussion shows slight dulness over left flank. No symptoms of anæmia, pulse 116. Operation was advised but refused.

The following morning the patient felt better, less pain, less tenderness and no signs of distention, pulse fair, 96 per minute.

Blood Examination.—On the day of admission, hæmoglobin 80 per cent.; on the day of discharge, 65 per cent.

The patient continued to improve and was discharged on the sixteenth day, feeling fairly comfortable.

CASE XV.—O. H., age twenty. Hospital No. 12486. Admitted to St. Luke's Hospital, May 1, 1922.

Family and Social History.—Negative.

J. C. McCracken

Past History.—Three years ago patient had malaria. Three days before admission noticed his feet and legs swollen and had nightsweats.

Present Illness.—About 12.30 P.M., on the day of admission, patient received a kick over the left hypochondrium from a fellow worker. Immediately he felt agonizing pain over the whole abdomen, especially over the left side.

Physical Examination on Admission.—Lungs and heart are negative with the exception that the pulse is rapid. Examination of abdomen shows tenderness and rigidity, especially over the left side, with dullness over both flanks. Operation was advised as diagnosis of ruptured intestines or spleen was made.

Exploratory laparotomy was performed by an incision in the upper left rectus. On opening the peritoneum a large amount of blood was found in the peritoneal cavity. On examination of spleen a rupture of internal surface was found. The external surface of the spleen was firmly bound to the abdominal wall, by dense adhesions. The rupture was packed with gauze, the abdominal wall closed, and the patient left the operating table in fair condition.

On the next day the patient complained of general abdominal pain, especially over the hypochondrium. On the fifth day after admission all the packing was removed. On the ninth day a fair amount of chocolate-colored discharge came from the wound. The stitches were all removed on the ninth day, considerable discharge from the wound, patient advised to lie on his stomach.

Four weeks after the operation patient could walk about, wound fairly clean, less discharge. The patient left the hospital advised to come back for daily dressings.

CASE XVI.—W. Z. F., age unknown. Hospital No. 12533. Admitted to St. Luke's Hospital, May 10, 1922.

Family, Social and Past History.—Unobtainable.

Present Illness.—On the day before admission, while quarrelling with a number of people, the patient received a number of blows over the head, causing contusion and several lacerations. He was brought to St. Luke's Hospital by the police. The head injuries were treated and the patient allowed to leave the hospital, for he complained of no other injury. The next morning at 9 A.M. he was brought back to the hospital complaining of severe abdominal pain; he appeared to be very sick, the radial pulse was very feeble. He had great pain in the abdomen, conjunctivæ and lips were pale. Breathing caused abdominal pain, but there was no great rigidity. Dullness obtainable in the lower abdomen. The patient was put to bed and given $\frac{1}{4}$ morphine and the Murphy drip begun.

He died one hour later.

CASE XVII.—Z. A. S., age thirty-two. Hospital No. 12733. Admitted to St. Luke's Hospital, June 7, 1922.

Family, Social and Past History.—Negative.

Present Illness.—Five hours before admission patient was knocked down by hand car. He became unconscious immediately. On recovery he felt pain in abdomen which was increased on respiration.

Examination on Admission.—At 3.15 P.M. patient is conscious but weak, drowsy, lips very anæmic, pulse weak and rapid, tenderness found over the left side of the chest, abdomen shows respiratory movement present, no rigidity palpable, slight tenderness found over the splenic region and slight dullness in the left flank.

He was put to bed with hot water bottles and $\frac{1}{4}$ grain of morphine and 1/100 atropine given hypodermically and the Murphy drip started. The next day the patient complained of pain in the abdomen, felt very thirsty and vomited after taking water. More tenderness on the left side, rigidity found on palpation with more dullness over left flank. The patient was put up in the Fowler position and

RUPTURE OF THE SPLEEN

the morphine and atropine continued. Hæmoglobin 50 per cent. Malaria parasites not found.

Patient continued to improve and leaves hospital on the twenty-first day.

CASE XVIII.—W. T. C., age twenty. Hospital No. 12827. Admitted to St. Luke's Hospital, June 21, 1922.

Family and Social History.—Negative.

Past History.—Five days before admission patient was assaulted and hit over the abdomen. He did not feel pain immediately, but one hour later he began to have general abdominal pains. He had no nausea, no vomiting, but felt thirsty on the third day after the injury. Bowels moved daily. Patient felt feverish last two days.

Examination on Admission.—Patient is weak, drowsy and exhausted, tongue coated, lips blue, pulse fair, 100 per minute, respiration quiet, slight tenderness over the left side of chest, tenderness all over the abdomen, most marked over the splenic region. No marked dullness on percussion over the left flank. Hæmoglobin 55 per cent., white blood-cells 11,500, red blood-cells 2,512,000.

Patient is put to bed in Fowler position, Murphy drip begun, and ice bag applied to the splenic region.

Patient made uneventful recovery, leaving the hospital at the end of the second week.

CASE XIX.—S. C. Z., age twenty-seven. Hospital No. 12926. Admitted to St. Luke's Hospital, July 6, 1922.

Family and Social History.—Unimportant.

Past History.—He says he had no malaria but had daily fever about two years ago.

Present Illness.—One hour before admission in a fight patient received a blow over the left abdominal wall. Soon afterwards he fell down unconscious and was immediately brought to St. Luke's Hospital in great shock. Patient was put to bed and $\frac{1}{4}$ morphine given and Murphy drip put on.

Physical Examination before Operation.—Patient looks anxious and complains of thirst. Abdomen somewhat distended and on percussion dullness is marked over the splenic region and over both flanks. Tentative diagnosis of ruptured spleen was made and operation advised.

Under general anæsthetic a right rectus incision was made along the outer edge of the muscle. Upon opening the peritoneum an amount of free blood was found. The spleen was ruptured. The pedicle was clamped and the organ removed and the abdomen closed by layer sutures. Fifteen hundred c.c. of saline solution were given intravenously. Blood examination before operation: hæmoglobin 60 per cent.; white blood-cells 22,600. Three days after operation, hæmoglobin 50 per cent.; white blood-cells 15,000. Malarial parasites were not found in the spleen. Stitches were removed on the tenth day and the patient allowed to sit up at the end of the second week and left the hospital in apparently good condition on the following day.

CASE XX.—L. S., age thirty-six. Hospital No. 13236. Admitted to St. Luke's Hospital, August 11, 1922.

Family, Social and Past History.—Negative.

Present Illness.—About an hour before admission, the patient while loading a ship fell into the hold, landing on the left side of the body. He was unconscious for a few minutes, but recovering consciousness felt pain in the left chest and abdomen. He was brought to St. Luke's Hospital at 3 P.M.

Physical Examination.—Patient weak and exhausted, lips anæmic, hands cold and clamish, swelling noted over left side of chest with air crepitus on palpation. Tenderness and crepitus found upon pressing over the third, fourth, sixth and

J. C. McCracken

seventh ribs in mid-axillary line. Abdomen not distended, respiratory movements limited, tenderness and rigidity found all over abdomen, more so on the left side. Dulness on percussion over the left side.

Patient was put to bed and given a hypodermic of $\frac{1}{4}$ morphine and the Murphy drip begun. He passed away at 8.15 before the arrival of the chief of the department.

Laboratory Report from a Partial Autopsy.—Abdomen tense and distended, free blood found in the abdomen but no fecal matter. Spleen though not enlarged was badly smashed, left kidney ruptured in two places, no perforation of the intestines. The left lung was collapsed with escape of blood upon opening the diaphragm.

CONCLUSIONS

(1) Rupture of the spleen in China is greatly increased by the coming in of modern civilization.

(2) Immediate operation is not always demanded or advisable. Great shock is a counter indication to immediate operation.

(3) Usually splenectomy is the operation of choice but bleeding may be successfully stopped by packing when adhesions prevent the removal of the organ.

(4) Great care is necessary to prevent injury to the tail of the pancreas.

(5) The incision through the left rectus muscle gives good exposure and is usually all that is necessary.

(6) In a country where large spleens are numerous, rupture of the spleen should be thought of in all cases of injury to the abdomen, followed by shock and evidence of hemorrhage.

ACUTE PERFORATED ULCER OF THE STOMACH AND DUODENUM*

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THE proper procedure in the operative treatment of acute perforated ulcer of the stomach and duodenum is still a warmly debated question. Whether or not more should be done than simple closure is the main point in dispute. The opponents of more radical procedure—usually a gastro-enterostomy—offer as objections: First: It is unnecessary; perforation curing the ulcer. Second: It adds to the mortality. Third: There is danger of spreading infection in the peritoneal cavity. Fourth: It is not satisfactory in 100 per cent. of the cases. Fifth: Re-perforation, hemorrhage, and stenosis are exceptional sequelæ. Sixth: The danger of subsequent jejunal ulcer. While, in reply, it is urged that: First: Perforation, alone, does not cure the ulcer in a large number of cases. Second: It does not affect the mortality in properly chosen cases. Third: The danger of spreading infection is of theoretical rather than practical importance. Fourth: While gastro-enterostomy is not always successful in relieving symptoms or preventing complications, it is so in such a large percentage of cases that there can be no longer any doubt of its specific effect. Fifth: Suture always narrows the lumen and the operation safeguards against secondary perforations and subsequent stenosis. Sixth: While subsequent jejunal ulcers are a possibility to be recognized, the incidence is extremely low.

Among the more recently reported series are Gibson's,¹ who, on the basis of sixty cases operated on at the New York Hospital, feels that closure alone is the operation of choice. Yet seven of his twenty-eight cases of duodenal perforation required secondary operation, though only one of twenty-eight recovered gastric cases needed further interference. Pool² comes to the conclusion that about one-third of the cases treated by closure alone develop later symptoms—usually pyloric obstruction, but feels that a definitely indicated gastro-enterostomy in these cases is better than a possibly unnecessary stoma at the original operation. Southam³ reports thirty-seven duodenal perforations, treated by simple closure, four of which, at secondary operation, showed chronic ulcer.

Smith⁴ reports forty-one duodenal ulcers, with simple closure, and four secondary operations. In Brenner's⁵ series of fifteen cases, all duodenal, three of twelve cases treated by closure alone (25 per cent.) required further operative treatment. Stewart and Barber⁶ report twenty-four cases from the Third Division of Bellevue Hospital, in none of which was any operative procedure other than closure necessary.

* Read before The New York Surgical Society, October 10, 1923.

On the other hand, Lewisohn⁷ as a result of study of his own cases and of a series of cases requiring secondary operation, feels that gastro-enterostomy should be done whenever possible, because of the possibility that the ulcer may persist. Deaver⁸ is strongly in favor of immediate gastro-enterostomy, feeling that if there is no shock or systemic toxemia before operation the mortality is not increased but may, on the contrary, be diminished. Cutler,⁹ reviewing a number of recent series, comes to the conclusion that gastro-enterostomy is advisable when the patient's condition warrants it.

Recently, Guthrie¹⁰ summarized the answers to a questionnaire on the subject of perforated duodenal ulcer. Of 150 surgeons replying, gastro-enterostomy (occasionally pyloroplasty) was done as a routine by twenty-two; by sixty-four, never; and by sixty-three, in a shifting percentage depending in varying degree on the condition of the patient, the size and induration of the ulcer and the degree of stenosis following closure.

Lately—chiefly from Continental clinics—reports of more radical procedures have been published. Hromada and Newman¹¹ report nineteen resections with fourteen recoveries. Paul,¹² from von Haberer's clinic, reports thirteen resections, with two deaths, and considers that follow-up reports show this to be a more satisfactory operation than closure, with or without a gastro-enterostomy, avoiding especially the danger of jejunal ulcer. Zoepffel¹³ reports twenty-three cases, with three deaths, and a mortality, during the period when resection was the operation of choice, of 21 per cent. as compared with 56 per cent. during the preceding five years. Noetzel¹⁴ and Brunner¹⁵ condemn this procedure as unnecessary and dangerous. At best it is possible only under unusual circumstances, with patients in good condition and in the hands of the most experienced operators; and in spite of the excellent reported figures the procedure should not be considered as a routine measure.

With surgical opinion still so divided, the report of individual hospital series seems justified, although, as Deaver points out, statistics are confusing, as early operation and skillful closure so overshadow all other considerations.

There have been twenty-five cases of acute perforation of gastric or duodenal ulcer treated on the first division of Bellevue Hospital, between October 1, 1919 and August 1, 1923. One case occurred in a woman of 43; the others in men in the following age groups:

20-30.....7	40-50.....6	60-70.....1
30-40.....7	50-60.....3	

The extremes were 20 and 67 years.

Seven of ten patients with duodenal ulcer gave histories on which a working diagnosis of ulcer could have been made; one had lost weight for a year; while in two, perforation was the first evidence of disease. Of fifteen cases with gastric ulcer, seven had histories suggesting ulcer; five had had various types of indigestion; and, in three, perforation was without previous

ACUTE PERFORATED ULCER OF THE STOMACH

warning. Thus perforation was not preceded by symptoms of ulcer in the same percentage in both groups.

When symptoms had been present, the average duration in the gastric cases (four years) was twice that of the duodenal group. Medical treatment had repeatedly relieved the symptoms of seven patients. One patient had been previously operated on for perforated duodenal ulcer, closure alone being done.

The symptoms and signs of perforation have been so well and often described that it seems necessary to emphasize only certain points. Vomiting occurred in 40 per cent. of our duodenal cases; in 80 per cent. of the gastric cases. When present, it was an early symptom and rarely occurred more than once. There was usually a conscious effort to prevent its repetition as it distinctly increased the pain.

Gibson has recently called attention to the importance of a short-lasting pain in the left supraclavicular fossa, which he feels to be a very characteristic symptom. We, however, have failed to elicit it in our recent cases.

Obliteration of liver dulness is a sign, the value of which is under discussion. We have felt satisfied of the absence of dulness in nine cases in which we did not feel that we could ascribe the change to distention.

Shock occupies an important place in the literature as a symptom of perforation. It is usually described as short-lived and followed by a free interval before the development of signs of peritonitis. Deaver speaks of it as probably common but not often seen, and says that apathy, rapid feeble pulse and low blood-pressure are rare. Brenner, in his review of fifteen personal cases, came to the conclusion that it was over-emphasized, finding it a factor in only one-fourth of his series. We have had the unusual experience of having four cases perforate under observation. Three of them had been admitted as ulcer; one for another condition. In none of the four had there been any recent change in the variety or intensity of the symptoms. One case perforated shortly after an examination by a group of students, twenty-four and forty-eight hours after a fluoroscopic examination with bismuth. In one of the four cases, perforation was preceded by a massive hemorrhage, as a result of which there was extreme shock and ultimate death, without operation. In the remaining three, operation revealed perforations with no attempt at closure and wide-spread contamination of the peritoneal cavity. In none of these was there any evidence of shock, the pulse not changing appreciably in rate or force, while the blood-pressure remained unaffected. There was no evidence of mental apathy, this being particularly true of one patient who had previously perforated. The man made his own diagnosis and was insistent on early operative relief. Shock was noted as being present in only one of the cases admitted shortly after perforation. It may, however, have been a factor in the poor behavior under anaesthesia noted in two others.

Pathology.—In ten duodenal cases, the perforation was, in all cases, on the anterior surface or upper border of the first part of the duodenum. The lesions were of two distinct types. There were four cases in which a clean-cut

perforation of 3 or 4 mm. in diameter was surrounded by normal, or at the most, a slightly oedematous duodenal wall. In six others, a perforation of about the same size lay at the centre of an area of infiltration which was usually 1.5 cm. in diameter, although in one case measuring 2.5 cm. across. Wilensky¹⁶ suggested that the acute perforation without surrounding infiltration might be embolic in origin, without previous disturbance of the physiology of the stomach or duodenum and therefore no impairment of function after simple repair unless a secondary ulcer developed about the site of perforation; while perforation in the second group was part of the biological phenomena of ulcer, with disturbance of intestinal function perhaps requiring more radical procedure, though not necessarily at the primary operation.

Brenner felt that the infiltration in the second group was protective in character and soon disappeared, following closure of the perforation. In his series the soft, non-callous ulcer predominated, and he believed it to be the more common type of perforating duodenal ulcer. It is our experience that the infiltration is part of the ulcer process and that it will persist following a closure of the perforation, with persistence or recurrence of symptoms.

In line with Wilensky's suggestion, we felt that the non-callous perforation might have a shorter history than the callous ulcer, or might even present perforation as the first symptom of disease. This has not been the case, however, only one non-callous ulcer perforating without previous symptoms, while, in three, ulcer pain dated back over one, five, and ten years, respectively. It may be that in these cases the entire indurated area sloughed away, but, unless this is the case, there is no apparent connection between the type of ulcer and the duration of symptoms.

Of fifteen gastric perforations, nine were at or near the pylorus; while six were in the body of the stomach. Of the former, two may have been duodenal, as they were exactly over the pyloric ring, with an obliterated pyloric vein which could not be identified. These ulcers were, in general, considerably larger than the duodenal, with a more extensive area of infiltration about the perforation. In only three of the fifteen was there no infiltration about perforations measuring from 2 to 10 mm. in diameter. As in the duodenal cases, these three presented ulcer histories of from four to twelve years' duration.

In three cases, all duodenal, the perforation was sealed by omentum at the time of operation. In these cases there had been a minimal amount of leakage, and the patients might well have recovered without operation. The appearance of the ulcer, with its adherent omentum, bore a striking resemblance to that seen in several patients operated on as interval cases, and suggests that in the latter there might have been at some time a perforation so rapidly sealed off that the patient thought only of an unusually severe attack of ulcer pain.

The peritoneal reaction varied, in degree and extent, with the size and location of the perforation, the delay in operation, and the contents of the stomach (either present at the time of perforation or added later for the relief

ACUTE PERFORATED ULCER OF THE STOMACH

of pain). It extended from small amounts of fibrin, practically no fluid and a normal peritoneum in the case of a small perforation already sealed off, through large quantities of fibrin with solid food particles and, in two cases, castor oil, to the exudate of a diffuse peritoneal infection.

Bacteriology.—There is little agreement as to the bacteriological findings in early cases of perforation. Deaver reports twenty-three sterile cultures out of thirty-four taken. Stewart and Barber say that the colon bacillus is usually recovered, in one of their cases six hours after perforation. Brenner, in his fifteen cases, had eleven negative cultures. Prader¹⁷ found negative cultures in four of ten early cases, and considers that sterility might be due to the acidity of the stomach contents checking bacterial growth until in later hours it is converted to an alkaline medium. Gibson implies that early positive cultures are uncommon, and quotes E. G. Alexander of Philadelphia, as saying that he has never obtained a growth within the first eighteen hours.

Cultures were taken and reported in ten of the early cases, four gastric, six duodenal. Only one of the gastric cases was sterile, while four of the six duodenal cultures were negative. The cultures, with the time elapsed and their relation to wound healing, were as follows:

<i>Gastric</i>		
Duration	Growth	Wound healing
4 hours	Sterile	Primary union.
7 hours	Staphylococcus albus	Primary union.
8 hours	Hæmolytic staph. albus.	Abdominal wall infection.
10 hours	Streptococcus viridans	Acute, diffuse peritonitis; death.

<i>Duodenal</i>		
Duration	Growth	Wound healing
3 hours	B. Coli communis	Primary union.
4 hours	Sterile	Abdominal wall infection.
6 hours	Sterile	Primary union.
7 hours	Sterile	Primary union.
7 hours	Non-hæmolytic strept.	Abdominal wall infection.
9 hours	Sterile	Primary union.

Operation and Mortality.—Operation was performed in all but one unrecognized case. In this case perforation was preceded forty-eight hours by a massive hemorrhage and was accompanied by a second severe hemorrhage, with death in three hours. Death was thought to be due directly to the hemorrhage until autopsy revealed a perforated ulcer of the pyloric region. In three cases, a refusal to operate might have been justified, as the patients were in serious or moribund condition, dying within six hours of operation. Even in these, however, it seemed fair to give the patient the benefit of peritoneal drainage, under local anæsthesia; in one case, with no attempt to locate or close the perforation.

There were, in all, seven deaths, a mortality rate of 28 per cent. As in

all reported series, the time factor is of primary importance in the mortality, our operative deaths being classified as follows:

Under 12 hours	17 cases	1 death	6 per cent.
13 to 24 hours	5 cases	3 deaths	60 per cent.
48 hours, or more	2 cases	2 deaths	100 per cent.

One case died without operation, primarily as the result of hemorrhage.

The duodenal mortality was one in ten cases; the gastric, six in fifteen, 10 per cent. and 40 per cent., respectively. In general, gastric cases seem to have a higher mortality; for instance, Gibson's figures of 12 per cent. and 21 per cent., respectively. Occasional series reverse these figures; thus, Schulein,¹⁸ reporting from Hochenegg's Clinic, has a duodenal mortality of 53 per cent., gastric, 33 per cent., and considers that the duodenal contents may be of greater infectivity, a conclusion not borne out by our bacteriological reports. Our figures are of no value in this connection as the time element is a predominating factor, five of the six gastric deaths being in cases of over thirteen hours' duration; the sixth, a non-operative death.

Procedure.—Closure of the perforation has been the first step in all but one case—a man in desperate condition, in whom a pelvic peritoneal drainage was performed under local anæsthesia, with no attempt to locate or close the perforation, which autopsy showed to be duodenal. In the nine remaining duodenal ulcers, closure alone was performed in five cases; closure and gastro-enterostomy in four. The indications for gastro-enterostomy, in our minds, have been: First, the good condition of the patient; second, the presence of infiltration of the duodenal wall extending well beyond the limit of the perforation; third, and of least importance, apparent stenosis as a result of the closure of the perforation. In three cases, closure alone seemed sufficient because of the absence of infiltration about the perforation; in two, gastro-enterostomy would have been performed but was postponed because of the patient's condition. In both of these there was a considerable degree of infiltration of the duodenal wall. One case was a re-perforation at the original site, the first operation being a duodenorrhaphy.

Re-operation has been necessary in three of the five cases treated by closure alone; in one case for obstruction; in two non-infiltrated cases, for persistence of ulcer symptoms. In both these, extensive areas of infiltration were found at the second operation. The remaining two—one a callous ulcer, the other, non-infiltrated—are well at present, both less than a year after operation.

Of nine pyloric ulcers, eight came to operation. Immediate gastro-enterostomy was done in two cases, both of which may well have been duodenal in origin. In both of these the pylorus was occluded by the closure. The remaining six were treated by closure alone. Three died, all late cases. Of the remaining three, one was well when lost sight of, six months after operation; one has had a secondary operation, a gastro-enterostomy for obstruction; and the third has persistent ulcer symptoms with X-ray findings indicative either of ulcer or of deformity following operation.

ACUTE PERFORATED ULCER OF THE STOMACH

Six ulcers of the body of the stomach have been treated by closure alone. Four recovered and have required no further interference.

Thus, of eighteen recovered cases, four (22 per cent.) have required secondary operation. They were all in what has been called the para-pyloric group, of which they form 30 per cent. Of the duodenal cases, three out of five treated by simple closure (60 per cent.) have required secondary operation.

Drainage is still a debated question, although apparently the tendency is away from it. Of one hundred and thirty-seven men answering this question in Guthrie's questionnaire, one hundred and one drained "always"; five, "usually." Winslow¹⁹ drained all but one of his twenty-nine cases, one-half of which, however, were over the twelve-hour limit. Stewart and Barber omitted drainage in only one of their cases. Souther²⁰ always drains the pelvis. On the other hand, Brenner considers it necessary only occasionally to drain the abdominal wall. Southam uses it rarely, only in cases of over eighteen hours' duration, and then through a suprapubic stab-wound; Smith closes after irrigation through a suprapubic stab-wound; Paul considers drainage necessary only if there is necrotic tissue or uncontrollable bleeding; Prader considers drainage inadvisable in early cases; Gibson feels that it is rarely necessary, and then, perhaps only in the later cases; Stillman feels that it is unnecessary if the perforation has been properly closed and the peritoneum cleaned by suction.

We are employing it in early cases with steadily diminishing frequency—at present, as a rule, limiting drainage to the abdominal wall and employing it only when there has been extensive peritoneal soiling, with resulting contamination of the abdominal incision. Our results have been as follows:

Cases closed without drainage	10
Primary union	6
Wound infection	3
Peritonitis	1
Cases closed with drainage	7
Union without infection	5
Wound infection	2

All the late cases have been drained.

Complications.—Pneumonia	6; 2 deaths.
Bronchitis	1
Parotid sialadenitis	1
Gastric fistula	1; 1 death.

The gastric fistula occurred in a large ulcer in which the closure of the perforation was difficult and unsatisfactory. If this case had come to operation early, rather than after twenty-four hours, resection might have been advisable, as the ulcer was near the pylorus, and resection would not have been a difficult procedure. It was not considered as peritonitis was already established. Gastrostomy has occasionally been done in cases of this type, but with poor results.

Follow-up.—Fifteen cases have been followed from one to four years. One other was lost track of after six months and there have been two recent cases which have been followed for less than a year. The results may be summarized as follows:

Duodenal Ulcer.—Closure and Gastro-enterostomy.

3 cases	symptom free	17;18;19 months.
1 case	occasional eructations	18 months.

Closure; Secondary Gastro-enterostomy

3 cases	symptom free	18;28;33 months.
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Closure.

2 cases	symptom free	2; 8 months.
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Pyloric Ulcer.—Closure and Gastro-enterostomy.

1 case	symptom free	45 months.
1 case	eructation after heavy meal	31 months.

Closure; Secondary Gastro-enterostomy.

1 case	epigastric pain with no relation to meals	12 months.
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Closure.

1 case	symptom free	6 months. (Lost track of.)
1 case	ulcer symptoms	24 months.

Gastric Ulcer.—Closure.

3 cases	symptom free	22;38;48 months.
1 case	epigastric pain after meals; relief following operation for perigastric adhesions	18 months.

Résumé.—In this series of twenty-five cases, shock has been an unimportant factor. It was not present in three of four cases perforating under observation.

Immediate gastro-enterostomy has not affected the mortality, there having been no deaths in the cases in which this operation was performed.

Intra-peritoneal drainage is rarely necessary in early cases.

The most satisfactory results to date have been in the duodenal group with gastro-enterostomy either primary or delayed. Six of seven cases treated this way are symptom-free, the remaining one improved.

Ulcers of the body of the stomach treated by single closure have also given satisfactory results.

The pyloric ulcers have been the least satisfactory, only one of four patients followed over a year being symptom-free.

Operative stenosis can be disregarded as an indication for gastro-enterostomy, unless complete.

Gastro-enterostomy is indicated in perforated duodenal ulcer, with surrounding infiltration, provided the patient's condition permits the additional time necessary for that procedure. In the perforated ulcer without infiltration closure alone may be adequate, and gastro-enterostomy should be postponed.

ACUTE PERFORATED ULCER OF THE STOMACH

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ASEPTIC TECHNIC FOR THE RESECTION OF INTESTINE

REPORT OF THREE ADDITIONAL CASES

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IN APRIL, 1887, the late Doctor Halsted read a paper before the Harvard Medical School, entitled "Circular Suture of the Intestine." This paper was the result of a series of experiments on the dog, and introduced the quilt or mattress suture in intestinal surgery. A further report of this work was made before the Medical Society of the Johns Hopkins Hospital in December, 1890. This with the work of Senn was the beginning of modern intestinal surgery. Too much credit cannot be given these men whose pioneer work will always be used as references.

Before the Section on Surgery, of the meeting of the American Medical Association in June, 1908, Dr. Frank B. Walker reported a method of end to end anastomosis of the intestine. To him should be given the credit of the first attempt to use the purse-string suture to make the bulkhead end to end anastomosis aseptic. Gatch, in 1912, reported a method in which the two ends of severed gut was held by clamps and the gut sutured by Cushing right-angled sutures.

More recently, Collins, Highsmith, Trublood, Halsted, Foley and Bidgood have described various methods of aseptic gut resections.

I merely mention the above historical data because of the interest that has been recently aroused, in men working on this problem from various parts of the country, as well as to call to attention several historical errors that have been made in the report of the work of several men.

In discussion I should say that the methods of Walker, Moschkowecz, Parker and Kerr, and Warbasse are practically the same. The methods of Gatch and Shoemaker are very similar. The methods of Bidgood and Highsmith are of the same principle and necessitate a special instrument. The technic used by Collins is a combination of the methods of Gatch and Walker in that he uses a purse-string and a clamp to hold the two ends of the severed gut. In the method of Grey the technic is broken in introducing plugs of fibrin into the lumen of the gut.

In the method described by the author in the original article, the only point of contamination as in any other purse-string method might be in contaminating the wound by putting the needle into the lumen of the gut. It was shown by Gatch that the use of the cautery in cutting the gut across was sufficient to produce a field sterile in a series of cases in which negative cultures were obtained. The advantages in this method are, first, no mechanical appliances are necessary. Second, the purse-string suture remains in the gut in the event that the bowel was punctured in placing the suture. Third, every step of the operation is carried on from without, nothing being introduced into the

ASEPTIC TECHNIC FOR RESECTION OF INTESTINE

lumen of the gut. Fourth, less time required than the ordinary methods. Fifth, the operation is entirely completed before the lumen is opened, as it is not necessary to put in any more sutures after the lumen has been restored. Sixth, both ends of the severed gut can be opened simultaneously so that the contents of one end will not contaminate the knot of the purse-string of the corresponding side.

In addition to the two cases reported in my preliminary article, I wish to add three more cases.

First.—D. J., man aged fifty-six, carcinoma of the sigmoid, operated by Doctor Holland and myself. Twenty-four hours after operation, passed fecal matter by rectal tube. Six days after, developed fecal fistula through which he passed some cherry seeds. Patient died on the eleventh day. Autopsy showed a fecal fistula from a loop of small gut that was adherent to the carcinoma of the sigmoid at the time of operation. It was a question then whether to resect this portion of gut or not. Diffuse peritonitis. The site of anastomosis was intact. No leakage. Cause of death, peritonitis from fecal fistula in small gut. Incidentally as a matter of interest there was a quantity of cherry seeds impacted proximal to the fecal fistula.

Second.—This patient was operated by Dr. Hugh Trout of Roanoke, Va. In a personal communication he states he has used this method successfully.

Third.—This man was operated by Dr. Arthur M. Shipley. W. P., a colored man, twenty-four years of age, with an acute obstruction was admitted to his service and operated. A mass was found in the splenic flexure of the colon, which later proved to be carcinoma by pathological report from Doctor Spencer. A cæcostomy was done and a resection by this method done three weeks later through a left transverse incision. Thirty-six hours after operation, expelled some gas per rectum. Three days after operation, normal bowel movement. Cæcostomy wound still functioning. Four weeks after resection cæcostomy was closed. Patient has been having normal bowel movement daily. No evidence of hemorrhage at any time. Eight weeks patient returns to the dispensary all wounds healed. Before discharge from the hospital a gastro-intestinal series made and a bismuth enema given. There was no obstruction, the bismuth passing up the descending, transverse and ascending colon into the lower ileum.

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UTERUS DIDELPHYS

NOTES ON ITS DEVELOPMENTAL ETIOLOGY
AND ITS CLINICAL SIGNIFICANCE

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It is natural that any organ of the body which has such a complicated development as that shown by the uterus and vagina should reveal anatomical variations from the normal. It is not at all surprising that such anomalies should be unnoticed during childhood, inasmuch as their function does not commence until the end of this period; but that a person can pass through adult life, successfully fulfilling the obligations attendant on raising a family in spite of such a handicap, without the anomaly being discovered, lends considerable interest to a condition which after all is not uncommon.

The following case,* upon which an operation was performed for reasons other than the anatomical variation, resulted in so interesting a specimen and gave such an unusual history that our interest was stimulated to further inquiries regarding the condition. The cases subsequently found complete the picture of an interesting clinical condition.

CASE I.—P. B. B. H., Surgical No. 17687. Admission of Louise F., a married, white, American housewife, age thirty-four, complaining of "falling of the womb."

Family History.—Interesting in that her mother has three breasts. One of her brothers was born "with all his organs inside." He lived only three days. As nearly as can be determined, the patient means that at autopsy, penis, scrotum and testicles were intra-abdominal.

Past History.—Always healthy and vigorous with good habits. Married six years. There have been four pregnancies. The first one terminated in a miscarriage at three and one-half months. The second occurred a year later. There was a twelve to fourteen-hour labor, ending after instrumental intervention in a still-birth, breech presentation. A severe laceration was repaired at this time. One year after this her third pregnancy ended at seven and one-half months. There was a short and comparatively easy labor though this was also a breech case. The child is living and well to-day. One year before admission, her fourth gestation terminated at full term in a normal healthy living child.

She had never been told by any of the various persons who attended her at these times that there was anything abnormal or unusual about her pelvic organs. It seems certain therefore that the condition was unrecognized.

There has been nothing out of the way about the marital relation to attract either her's or her husband's attention.

Her catamenia began at fourteen years of age and have been painless and regular until interrupted by her pregnancies. There has been a profuse leucorrhœa most of the time since her periods began.

Present Illness.—Ever since her second pregnancy she has had dragging pain in the pelvis, accentuated at the time of her periods, and accompanied by backache

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UTERUS DIDELPHYS

and headache. During the last two years she has been nervous and irritable and has felt something protruding from the vulva when she was standing. The sense of pelvic pressure and backache has been much worse during this time. Frequency at half-hour periods when on her feet has also been present. She has felt tired most of the time. Her last regular period was completed two months before entry to the hospital.

Physical Examination.—The general physical examination was quite negative except for the local findings. The patient was well developed and appeared healthy and normal in every other way. Our attention naturally focussed on the pelvic condition and in the light of subsequent findings it is interesting to record in detail



FIG. 1.—Case I. Didelphic uterus, tubes and ovaries. Antero-posterior view of fresh specimen.

the note of the examination made before the patient was taken to the operating room. It reads: "Introitus marital, color normal, evident muco-purulent discharge. Protruding from the labium majore is a soft, pinkish, non-tender, reducible mass, which seems to be an unusually redundant fold of the anterior vaginal wall. Slight rectocele. Cervix comes well down to just outside the vestibule when the patient strains, is of normal size, color and consistency, and shows a small stellate laceration. Uterus of normal size, freely movable, and in third degree retroversion. It is difficult to outline the uterus because of the depth of the pelvis. No tenderness or masses in either vault. Adnexa not palpated. Perineal body small and thinned out."

Rectal examination added nothing.

A diagnosis of prolapse was made and operation advised.

November 6, 1922. Operation. Ether Examination. Supravaginal Hysterectomy for Prolapse. Fixation of Cervical Stump. (Didelphic Uterus.) Under ether anesthesia a careful pelvic examination was done with the following findings:

The fold of the anterior vaginal wall, believed at the time of previous examination to be a cystocele with a large redundant fold as a result of obstetrical

repair, proved to be a complete septum running from the anterior to the posterior vaginal wall. This fold could be pushed to either side with ease, revealing two vaginal canals at the upper end of each of which there was a normal cervix. These were alike in size, and had similar lacerations of a stellate character. Both the cystocele and rectocele proper were moderate in degree. A uterine probe was passed into both cervixes without obstruction, deviating to the right and to the left, respectively. At no point could a communication be made out between the two canals. The left uterine cavity was slightly deeper than the right. Traction on either cervix showed the double uterus to be very freely movable. Both could be delivered outside the labia for a distance of two centimetres. When one cervix was

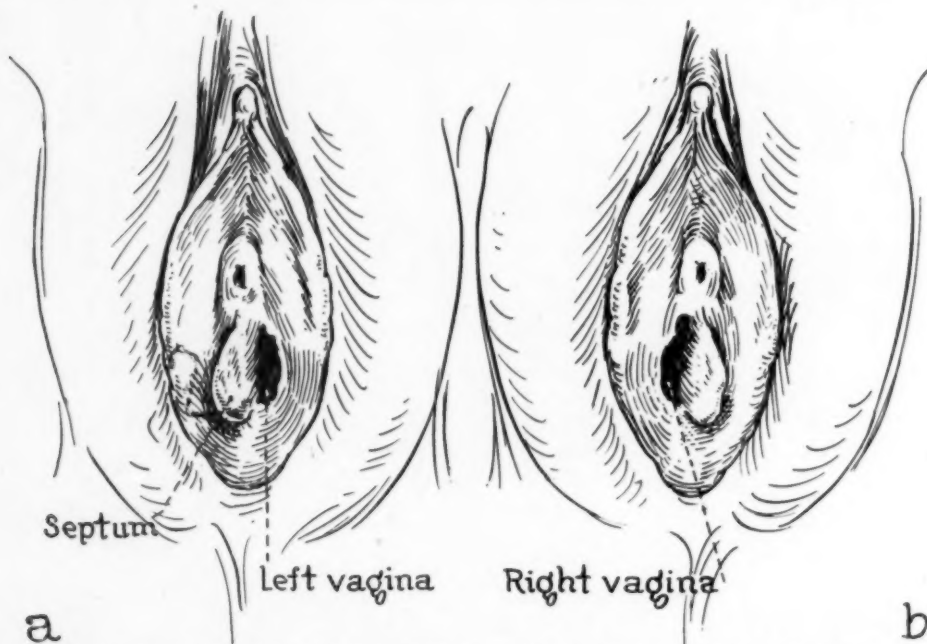


FIG. 2.—Case I. Drawing of external genitalia illustrating the attachments of the vaginal septum.

being examined it was not possible to see the other, the redundant septum appearing to be only the lateral wall of the vagina.

No plastic operation was done below in view of these findings, the abdominal operation being relied on for relief of the prolapse.

Examination of the pelvis above through the usual midline suprapubic incision revealed a double uterus, with one tube and ovary attached to each outer cornua, the two fundi joining at about the level of the internal os of the cervix. The left uterus was nearly as large again as the right one, and was somewhat soft. The left ovary was at least three times bigger than the right one and had a definite corpus luteum. Inasmuch as hysterectomy had been advised and agreed to by the patient, and also because it was thought probable that pregnancy had been interfered with by the probing below, the uterus and adnexa were removed. When the cervix was cut across it was again demonstrated that the two cervical canals were perfectly intact, communicating nowhere with each other. The cervical stump was fixed to the anterior abdominal wall and the abdomen closed.

Recovery was uneventful. The wound healed perfectly. She was discharged November 24, 1922, twenty-one days after operation, and at the time of this writing (ten months later) reports herself well and happy, entirely relieved of symptoms.

UTERUS DIDELPHYS

Pathological Note.—(The specimen was at once cut in a plane parallel to the cervical and uterine canals. See Fig. 5.)

The uterus is divided by a septum into two portions, the septum running from the fundus down through the cervix to the point of amputation. As the septum runs upward between the fundi it becomes broader and somewhat triangular in shape. The left uterine cavity in the region of the cornu is occupied by an irregularly spherical mass approximately $1\frac{1}{2}$ cm. in diameter. On cut section, it is grayish-white, somewhat elevated above the surrounding endometrium. In the centre of this mass is a small sac in which there is an embryo 7 mm. in length. The remaining mucous membrane of both the right and left uterine cavities is grayish-pink, markedly oedematous and hypertrophied, and presents the typical appearance of decidual tissue. The cervical canals are $\frac{1}{2}$ cm. in diameter.

Histological Note.—A section taken from the non-pregnant uterus shows mucosa containing very large and tortuous glands, having marked infoldings of epithelium. There are also solid masses of rather pale-staining cells, characteristic of decidual cells.

Six months later a second case came to us with a very different story but with what proved to be a similar anomaly, that is, a double uterus.

CASE II.—P. B. B. H., Surgical No. 19045. Lottie B., married, white, Canadian domestic, thirty-three years old, admitted complaining of swelling of the lower abdomen.

Family History.—Essentially negative. She knows of no variations from the normal in others of her family.

Past History.—Seven years before entry she came to the out-door department of the hospital with a generalized rash. A diagnosis of lues was made and treatment with mercury and salvarsan begun. The year following she had two Bartholin's abscesses on the left side which were opened. The next year she married, had a miscarriage at $2\frac{1}{2}$ months, and was curetted at another hospital. This patient also was never aware that there was anything abnormal about her.

Present Illness.—Three years before entry she discontinued her luetic treatment though her Wassermann remained positive. One year before coming in, she noticed that her abdomen was getting larger without any pain or discomfort being associated with it. Her periods continued normal in amount, but irregular in incidence. A week before entry she first had some pain in her abdomen which exertion made worse. She became nauseated frequently and her appetite disappeared. The pain gradually became unbearable, so she sought relief in the hospital.

Physical Examination.—Except for the abdominal and pelvic examinations there was nothing abnormal found. The patient was in excellent condition. Her abdomen was negative except for a firm, symmetrical mass extending from symphysis to umbilicus, rather tender, fixed and flat to percussion. No fluid wave could be demonstrated. There was no spasm. Pelvic examination showed a marital introitus and a mucoid vaginal discharge. Scars of the incisions for Bartholinitis were readily seen on inner border of left labia. There was no discoloration of the mucous membranes. Rather high on the right wall of the vagina there was an outpocketing which was too small, however, to admit the tip of the gloved finger. The cervix was posterior, and of normal color and size. A mass about 15 cm. in diameter, large, round, fixed and firm, slightly tender to touch could be felt filling the left vault extending well above the symphysis. The adnexa were not palpable.

Diagnosis.—Left ovarian cyst. Operation advised.

June 16, 1923. Operation. Excision of Cyst of Broad Ligament. (*Didelphic Uterus.*)—Abdominal exploration revealed a large cyst of the left broad

ligament about which was coiled the sigmoid and left tube and ovary. The cyst was removed intact, disclosing the following anomaly: Two uteri were seen, entirely separate, occupying positions on opposite sides of the pelvis, both with very short round ligaments and one tube and ovary lying in each case on the lateral side of the organ. The right uterus was very small and rudimentary, though perfectly formed in every part. The left uterus was of approximately normal size. The tube and ovary here were much attenuated and distorted by the cyst, which appeared to have arisen from the ovary. The cervix of the right uterus was very rudimentary though a thickened cord-like structure could be felt running downward

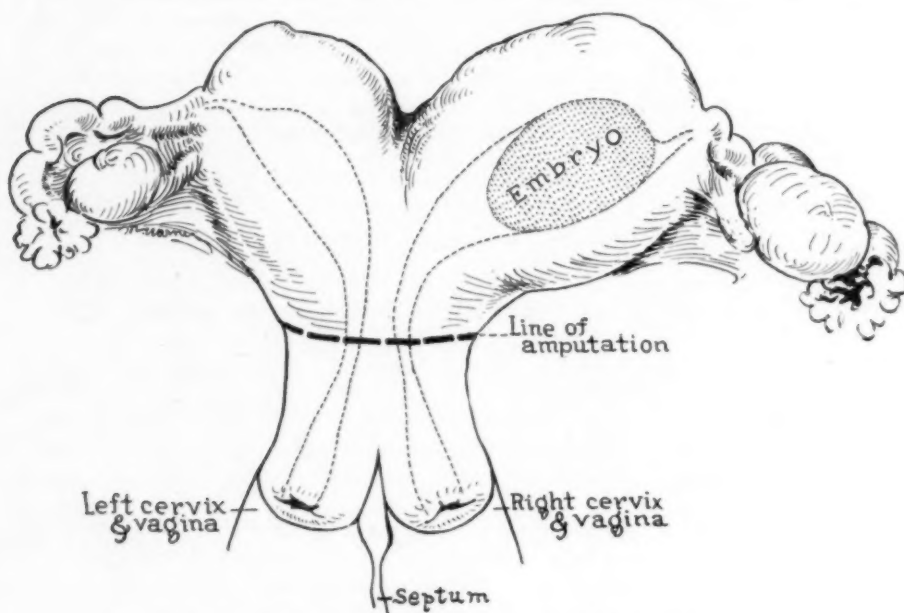


FIG. 3.—Case I. Diagrammatic representation of condition found at operation.

towards the vagina along the lateral pelvic wall. All denuded areas were carefully covered with peritoneum and the abdomen closed.

Recovery was quick, the patient being discharged July 1, 1923, fourteen days after operation. Three months later she is without symptoms.

Pathological Note.—Simple ovarian cyst.

The following cases are added through the kindness of Dr. H. S. Day, from whose private practice they are taken:

CASE III.—E. M. W., a married, white, housewife, age thirty-nine years, complaining of low right-sided pain.

Family History.—Negative.

Menstrual History.—Matured at fourteen. Always regular, twenty-eight day interval, four days' moderate flow.

Past History.—Married at twenty. There have been eight pregnancies. The first was a miscarriage at eight lunar months. The last three deliveries were instrumental. The oldest child is now fifteen.

Physical Examination.—Showed a rather small woman, weight 115 pounds, height 5 feet. Temperature 99.2. Abdomen relaxed. Pressure above symphysis caused pain, especially on the right side. No cystocele or rectocele. Slight

UTERUS DIDELPHYS

leucorrhœa. Cervix very deeply lacerated and apparently adherent to the vaginal wall in such a way as to seem to be held open. The fundus of uterus not found. In either cul-de-sac is a large tender mass, apparently slightly movable. There is more tenderness on the right side.

Diagnosis.—Lacerated cervix. Subacute bilateral salpingitis.

November 13, 1922. Operation. Median laparotomy.—Examination of pelvis showed a double uterus with a normal-sized body lying in each cul-de-sac. Each had a tube and ovary on the outer side. The left tube and ovary were normal. The right tube showed chronic salpingitis. The appendix was removed. Examination of the cervix while the patient was still under ether showed a partition apparently separating the cervix into two mouths. This partition extended from

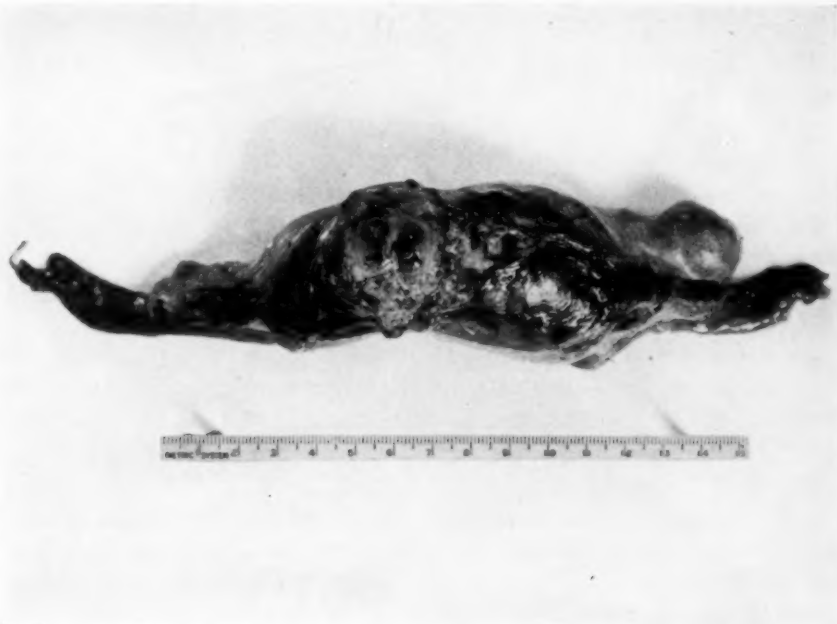


FIG. 4.—Case I. View from below of fresh specimen, showing integrity of the two cervical canals.

above downwards, but did not seem to be completely attached to the posterior vaginal wall.

Examination a month later showed patient to be entirely relieved of symptoms.

Pathological examination showed perisalpingitis.

CASE IV.—C. K. G., a single, white woman of twenty-nine years, first seen in June, 1918, at which time she was recovering from a slight attack of appendicitis. Second attack observed in December of same year, accompanied by slight pyrexia. No history of any menstrual disorder.

December 11, 1918. Operation. Appendectomy.—Appendix found kinked and adherent. Pathological report showed healed appendicitis. At the time of operation, through the right rectus incision there was found a complete absence of tube, ovary and round ligament on the left side of the uterus. The uterus seemed to be of normal size and was in nearly normal position. The ovary on the right side appeared somewhat large. The wound was closed and the patient made an uneventful convalescence.

In December, 1922, she consulted another surgeon because of sterility, having been married since her first operation. An exploratory operation through a left rectus incision revealed an enlarged ovary on that side, upon which a plastic operation was done. At this time two uteri were found, of similar size, and apparently normal in size.

As previously stated, uterine anomalies are not particularly rare. We are continually meeting with one type or another clinically, at operation, or at autopsy. Keibel and Mall¹⁴ give us a very complete classification of the various inhibitions of development of the uterus and vagina, outlining the normal transition from mesonephric fold to the sexually mature uterus and grouping alongside each step in the development the various deviations from the normal.

Briefly, they find seven definite steps in the production of the normal uterus and vagina. They are: (1) A completely developed mesonephric fold with as yet no trace of the Mullerian ducts; (2) appearance of the funnel of the tube in the mesonephric fold, an outgrowth of both blind ends as Mullerian ducts into the urogenital fold; (3) union of the two ducts, at first in the centre, to extend cranially and caudally; (4) rounding convexly of the flat uterine fundus; (5) strong growth of the cervix; (6) strong growth of the corpus of the uterus; (7) and finally a general growth and enlargement into the sexually mature organ.

We are able, therefore, by means of this division of development to say of any uterine anomaly—at this point deviation from the normal took place. Anomalies which show absence of tubes, uterus and vagina of one or both sides are the result of faults in the completion of step (1). All double forms of uterus and vagina result as step (2) goes astray. When the Mullerian ducts fail to completely unite step (3) the bicornate forms of uterus appear. And so, too, with the last four steps; the uterus either remains flat, has an infantile cervix and vagina with normal-sized fundus, or *vice versa*, or remains small and undeveloped throughout.

Uterus didelphys is therefore the end result of a very early variation, and is also much more infrequent than are the later variations. In the first case reported here fusion of the Mullerian ducts did not take place to form a single tube in the mesonephric fold, but each duct went on to complete development side by side. In the second case, the ducts not only did not fuse but remained separate, only one developing fully. The last two cases are similar to the first.

A number of theories have been advanced to account for these disturbances. Keibel and Mall¹⁴ have collected nine from the literature. Hydro-nephrosis, distention of bladder and rectum, anomalies in the formation of the abdominal wall such as hernias, cleft pelvis, etc., and fetal peritonitis, they throw out as untenable because these factors must occur after the fusion which forms the utero-vaginal canal. Thiersch (1852), Frankl (1902) and Holzbach (1909) believe that long persistence and too great a separation of the mesonephric are the causes. R. Meyer (1898) attributes it to an abnormal shortness of the round ligament, together with too great breadth of

UTERUS DIDELPHYS

the pelvis. Pick (1896, 1898) believes that tumor formation between the ducts, from detached germinal tissue, is more likely the reason. He found tumors present in thirty cases of double uterus. Others state that a persistence of the ligamentum rectovesicale is the contributing factor. Each theory has much in its favor as well as valid objections which we cannot go into here.

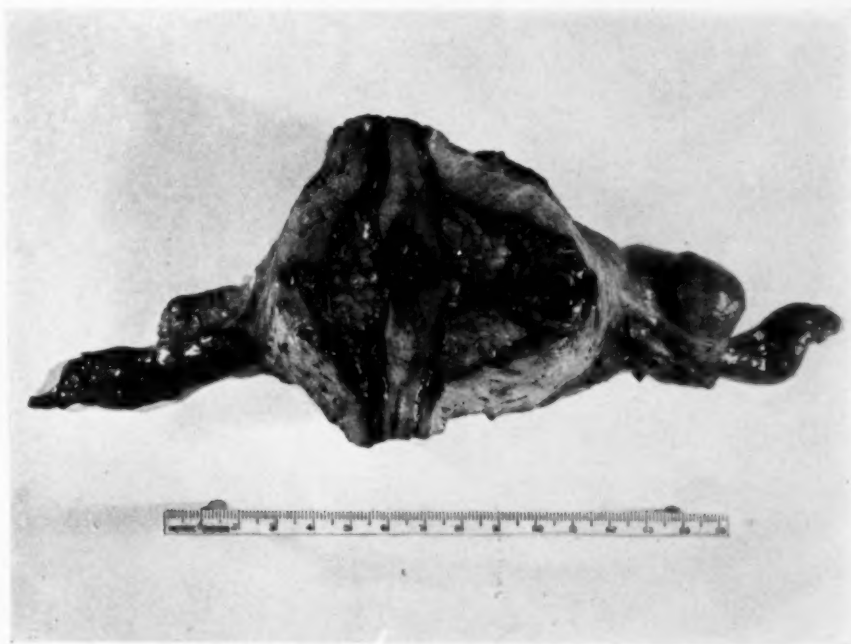


FIG. 5.—Case I. Sectioned fresh specimen. Note fetal sac, also decidual lining of both uterine cavities.

It seems evident therefore that these variations cannot be explained on any single basis.

Though the following cases by no means constitute all of this type which the literature yields, they serve, together with our own, to illustrate the clinical significance of these developmental anomalies.

1. WIENER'S Case.³¹ A woman of twenty-two, with complete double uterus and vagina, who had first a miscarriage for which she was curetted, decidua being found on the non-pregnant side, and then successively a normal pregnancy on right and left sides. Previous to the completed pregnancies the vaginal septum was resected. As the pregnancies progressed the non-gravid side was gradually taken up until at term it was hardly palpable. The labors were eight and twelve hours, respectively, and uncomplicated in any way. Each child showed a slight anomaly of development in hand or foot.

2. HYDE'S Case.³² A young woman in whom a didelphic uterus was discovered, and on whom an operation was performed for removal of the vaginal septum in preparation for marriage. Six months after marriage she became pregnant. She went to full term without trouble and delivered a normal healthy child.

3. SHOEMAKER'S Case.³³ A twenty-four year old white woman with double uterus and rather fibrous vaginal septum, who miscarried at 2½ months, to become

pregnant later on the right side. She came to term, started a normal labor, but was delivered by Cæsarean section of a normal, healthy baby.

4. ARANOW'S Case.⁹ An Austrian of twenty-four years with complete double uterus and vagina, who miscarried six months after marriage and was curetted. Postpartum infection followed. She came to Aranow because of sterility.

5. COWLES' Case.⁷ A twenty-three year old woman with uterus didelphys, who became pregnant four years after marriage, went into labor at term, but after making little progress forty-eight hours after rupture of the membranes was delivered by Cæsarean section and a subtotal hysterectomy done. The child had a slight deformity of the left hand. Two years later she became pregnant again,



FIG. 6.—Case I. Fixed specimen. Note embryo within fetal sac.

on the remaining side, and was delivered at term by Cæsarean section of a baby who was healthy and normal except for a slight deformity of one foot.

6. VINEBERG'S Cases.²⁰ (a) A woman with double uterus and vagina, who had had numerous pregnancies, some resulting in miscarriages. Both cervixes were lacerated, indicating function of both sides. (b) A woman twice pregnant on the same side. During the first pregnancy, by pressing on the opposite side, decidual tissue could be expelled. This manœuvre caused a drop in the slight fever the patient was showing. Both pregnancies terminated in normal deliveries. (c) A patient of thirty-one, who was successively pregnant on the right and left sides, miscarrying both times.

7. RONGY'S Case.²⁴ A woman with double uterus, who miscarried at four months and five months, later gave birth to a full-term child.†

8. JOHNSTONE'S Case.¹⁵ A woman who died of eclampsia after forceps delivery without difficulty. At autopsy a double uterus and double vagina were found, the non-pregnant side containing a thick layer of decidual cells.

† Though the author does not explicitly say so, there must have been pregnancy on each side at the same time in this instance.

UTERUS DIDELPHYS

Clinical Significance.—These few cases, briefly abstracted, with the cases reported here, emphasize the following facts: Uterus didelphys may well be more common than is believed inasmuch as many cases are not recognized at once, and others not even after repeated examinations. Though opinion varies considerably as to the advisability of allowing such patients to go through a normal labor, still many do so without untoward results. Miscar-

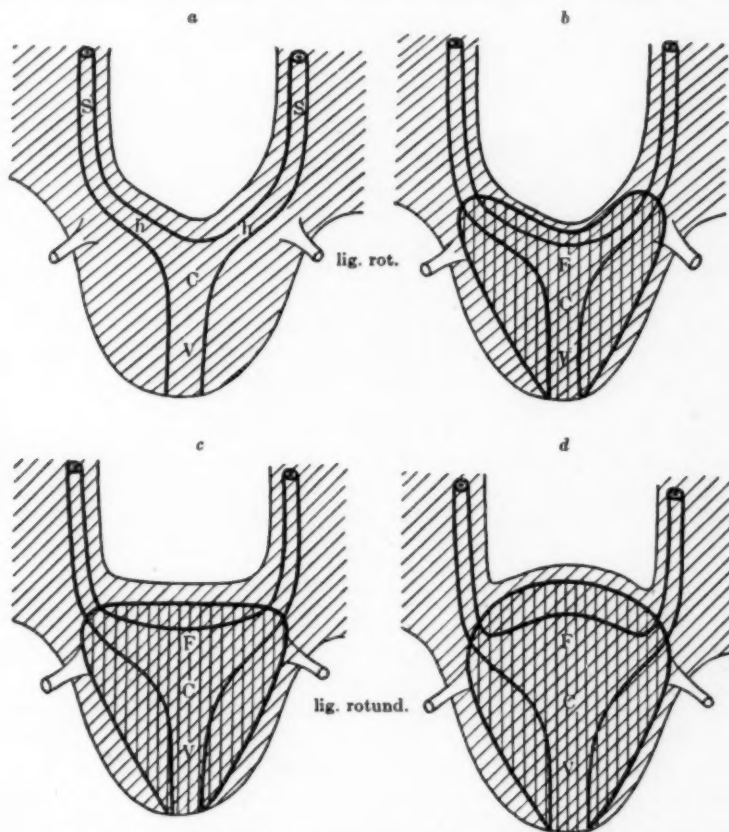


FIG. 7.—(Reproduced from Keibel and Mall.) Four diagrams of the development of the external form of the female uterus. The mesonephric folds and the genital cord are shaded obliquely, the mesenchymatous uterine wall vertically. The various parts of the primitive uterine wall and of the utero-vaginal canal are lettered. S, vertical portion; h, horizontal portion of the wall of the primitive tube; F, fundus uteri; C, cervix uteri; V, vagina. Diagram (a) shows the position of the primitive tubes and of the utero-vaginal canal after it is completed. Diagram (b) shows the relation of the mesenchymatous uterine wall to the primitive tubes and to the utero-vaginal canal. It encloses the whole of the horizontal portion of both tubes in the uterine region and as a result the lig. rotundum is brought into relation with the uterine wall. The fundus uteri is bent in at an angle (*uterus introsum arcuatus*). Diagram (c) shows the broadening of the horizontal portion of both tubes to form the fundus uteri, the broadening taking place in such a way as to straighten out the inward bend (*uterus planifundus*). Diagram (d): The broadening of the fundus has increased and it is curved outward (*uterus foras arcuatus*).

riages are not uncommon in these cases and this factor is usually the first symptom of anything abnormal which causes the patient to seek medical advice. The possibility of double pregnancy is always present, though rare. Resection of the vaginal septum would conceivably make this more likely, though we have little data to support this belief. One thing seems indisputable. This anomaly proves no bar to the normal fulfilment of the marital

function, and when combined with careful observation and prenatal care, normal labor or Cæsarean section make it possible for patients with this deformity to have children. An interesting observation in such cases is the appearance in the non-gravid side of decidual membrane.

To Summarize.—Four cases of uterus didelphys are reported. This condition, one of the rarer uterine anomalies, is the result of a failure of fusion between the two Mullerian ducts. It is usually unrecognized until pregnancy occurs and is no bar to the successful termination of the latter.

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ENCYSTED FOREIGN BODIES*

BY FRANK PASCHAL, M.D.

OF SAN ANTONIO, TEXAS

FOREIGN bodies may be introduced from without or originate within the body. "The presence of a foreign body excites the assemblage of phagocytes and leucocytes, which aid in the granulation tissue developing about it. Large multinuclear giant cells form and cling to the foreign body. These cells resemble the physiological osteoclasts, and, in unabsorbable substances, gradually



FIG. 1.—Arrow point encysted for sixty-one years without causing inconvenience or pain. It is between the second and third ribs, never removed.

give place to a capsule of scar tissue which encapsulates the body. In cases of smooth bodies, like glass, the amount of granulation tissue may be very small. The leucocytes also play an important rôle in the reaction against foreign bodies. They usually quickly assemble at their site, take them up when possible, penetrate into crevices, and aid in the process of destruction. Fibroblastic proliferation follows or is associated with the assemblage of

* Read before the Texas Surgical Society, October 9, 1922.

ENCYSTED FOREIGN BODIES

leucocytes. Many of the fibroblasts act as phagocytes and also aid in encapsulation." The toleration of foreign bodies depends largely upon the absence of infection. Sometimes, even under the most unfavorable conditions, foreign bodies that have been introduced from without become encysted, remain so, and are carried a lifetime without pain, inconvenience or knowledge of where they are lodged. As an instance, the X-ray photograph (Fig. 1) presented shows an encysted arrow-head. The subject at the age of sixteen was engaged in an Indian fight, May 12, 1858, with Commanche Indians, in what is now Ellis County, Oklahoma. The arrow penetrated below the seventh rib. He died at the age of seventy-seven. During the sixty-one years, he was not annoyed by its presence and carried it with him to his grave. He told me that when the shaft pulled away from the arrow-head, that one of his companions attempted to cut down on the point with a jack-knife. This he said came near finishing him; but notwithstanding a dirty arrow-head and a jack-knife wound, he escaped infection, and the point encysted for years was of no consequence to his well-being. But we know that the wind is not always tempered to the "shorn lamb." In contrast to the above case is the following: A Mexican, male, age thirty-eight, in seeking relief

stated that when eighteen years old, he was wounded by Indians. That an arrow-point that could not be removed had remained in his back for twenty years. That during the first eight years it did not trouble him, but after that time, an abscess formed at the seat of entrance and that he had suffered for twelve years. Upon examination there were discharging sinuses and healed abscess surfaces from the middle of the dorsal region of the spine almost to both feet. The point was easily located about the middle of the dorsal region, about two inches from the spinous processes in the lumbar muscle. There was no difficulty in its removal. The point had become very rough and oxidized. He carried the arrow-point for twenty years, eight of which were without discomfort and twelve of misery.

Coincidences in cases are sometimes queer. A Mexican, male, age twenty-eight, occupation blacksmith, came into my office one night complaining of

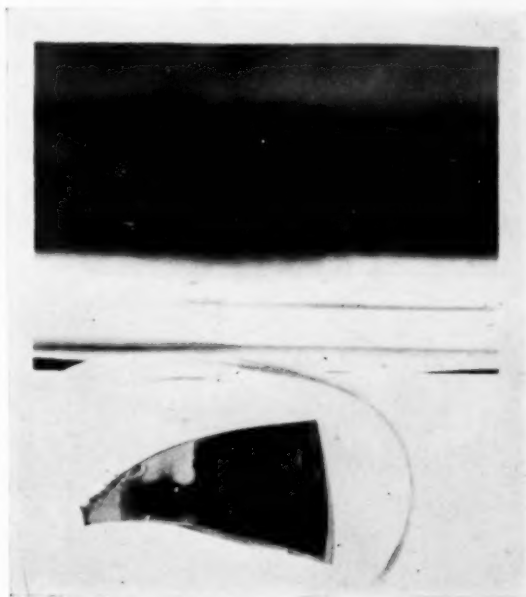


FIG. 2.—Piece of glass encysted for eight years and which gave no trouble until accidentally revealed by a blow.

severe pain in the anterior aspect of the middle right thigh. He stated that about four o'clock that same afternoon that in breaking a piece of iron part of it flew off and struck him on the thigh; immediately he began suffering severe pain at the seat of injury; that he did not know whether a piece of iron had penetrated the thigh; that eight years before, he had fallen on a piece of glass bottle; that he noticed at the time a small wound, but paid no attention to it, and that he had never suffered until he was struck by the

piece of iron. Upon examination I found a small fresh wound in the middle of the thigh; further examination revealed a piece of glass (Fig. 2) which was found about one-half inch in the external vastus muscle. This body was only revealed by the accidental blow, otherwise it might have remained there during his lifetime. It was easily removed, and prompt relief followed. But notwithstanding that foreign bodies may become encysted and not give rise to trouble, we all can, no doubt, recall cases where foreign bodies have been quiescent for twenty, thirty, or more years and then all of a sudden inflammation developed at their site, an abscess formed, and if the body could not be removed, trouble would result and possibly death.



FIG. 3.—Bony plates (4) found in four atrophied eyeballs. In centre a foreign body from abdomen.

As an example of foreign bodies originating inside the body, the four small bony plates shown in Fig. 3 were found in the interior of atrophied

eyeballs which were enucleated as a means of preventing blindness, from atrophy of the optic nerve of the remaining eye. You will notice in two of the pieces a small foramen, possibly the opening for a nutrient blood-vessel. Of course such plates are not infrequently found in eyes that have atrophied, nevertheless, they are interesting in showing how long they can be carried and give rise to little or no trouble. The sympathetic atrophy of the optic nerves of the sound eyes was not due to the bony plates, and they probably played no part in their production. Each of the bony plates exhibited are from four atrophied globes. They are probably bony degeneration of the retina. They occupied their site. You will notice a small round body in the centre

ENCYSTED FOREIGN BODIES

of the bony plates; it is shown as an interesting connection with a case. Recovering the piece was merely accidental. About 1886, before we knew anything about appendicitis, but considered such cases as typhlitis and perityphlitis, an American woman about forty-five, was seized suddenly with pain in the right side over the caecal region. This was followed by high fever, and finally a circumscribed peritonitis. Through the cul de sac a collection of pus could be felt, and it was reached by an incision behind the uterus and drainage established. Several days after the operation, an examination revealed the small body emerging by the side of the drainage tube. If it played any part in causing, what I did not know then, but do now, a perforated appendix, I do not know, but think its presence probably in the appendix was coincidental.

A practical question to be deduced from this paper is whether foreign bodies, for instance, bullets, that can be located, and can be removed with safety, should be allowed to remain and chances taken of no harm resulting, or should they be removed early? The tendency seems to be to let them alone. Personally I believe that if such cases are seen soon after the foreign body has entered, that it would be better not to let the patient take chances, because we can never tell how strongly encapsulated it may become, if encapsulated at all; or how potent the defenders of the fort may be; or how virulent and powerful the invading pus germs that may enter and storm the fort. After years of toleration of a foreign body, and there are no indications for its removal, then, of course, it would be better to wait.

SACRAL ANÆSTHESIA*

By EDWARD C. BRENNER, M.D.

OF NEW YORK, N. Y.

SACRAL or caudal anæsthesia has been safely and rather successfully employed in many of the Continental Clinics for over a decade. Its dilatory application in American surgery has been due to several unfortunate impressions: (1) That this type of regional anæsthesia is closely related to spinal anæsthesia, (2) that it is hazardous, (3) that special skill and technic are necessary for its success, and (4) that the resulting anæsthesia is uncertain both as to degree and to anatomical distribution.

Sacral anæsthesia is extradural nerve blocking of the sacral sensory nerves. It is purely a conductive anæsthesia by which a more or less extensive

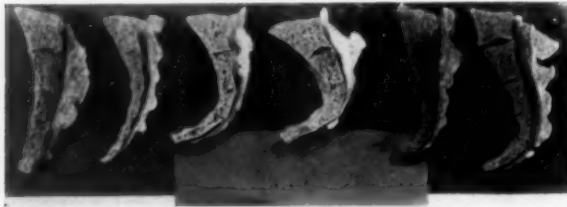


FIG. 1.—Variability in the size and curvature of six sacra.

complex of sensory nerves are interrupted. The anæsthetic acts upon the nerves only after they have left the dural sheath and therefore should not be confounded with spinal anæsthesia. Moreover, with proper technic it is

impossible for the injection fluid to enter the dural canal.

Cathelin in 1900 injected 3 c.c. of 1 per cent. cocaine solution into the caudal foramen of dogs and produced extensive anæsthesia. Later his attempts to anæsthetize the sacral nerves in humans suffering from pelvic neurosis proved futile. With the advent of the relatively non-toxic agents, stovaine and novocaine, a new impetus was given to nerve blocking. Stöckel, in 1909, modified Cathelin's technic and successfully employed sacral anæsthesia in ameliorating the pains of labor and in producing anæsthesia for plastic perineal operations. Stöckel was followed by Schlemptert, Schneider and Koenig. Each added his quota in exploring and developing this new field. Enthusiasm led them to use increasing amounts and with the addition of narcotics they were able to perform abdominal operations. This they termed high extradural anæsthesia. Some cadaver experiments to be referred to later will indicate the possibilities of high anæsthesia.

Läwen and Gros in 1910 reported excellent results from the use of one and two per cent. solutions of novocaine in normal saline solution and later increased the intensity of the anæsthetic by the addition of sodium bicarbonate. Some American surgeons were impressed by the steady progress of the sacral

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SACRAL ANÆSTHESIA

technic and since 1916, Lewis and Bartels, Pickens, Thompson, Lynch, Syms, Scholl and others have added their records of experiences. However, the paucity of published data should encourage other observers to report their successes and failures, especially the latter, if sacral anæsthesia is to be perfected to the proper degree of more general application which it merits.

The writer first employed sacral anæsthesia in 1918 and meeting with only quasi success attempted some experiments upon cadavers to investigate (1) the anatomy of the sacral canal (the description of which in most anatomies is rather incomplete or absent), (2) the course taken by injections of various quantities of solution, realizing that such findings are only relatively accurate when applied to injections in *vitam*.

The first anatomical point worthy of mention is the great variability in the curvature of the lower sacral bone segments. In males the curvature is more pronounced than in females. Secondly, the sacral ligament (sacroccygeal ligament), overlying the sacral hiatus, is variable in size and shape. In general it is rather triangular, less often quadrilateral. Except in the obese, the hiatus is readily palpated at the lower end of the sacrum by sliding the finger upwards from the tip of the coccyx until an elastic-like membrane is felt between the cornua of the sacrum and coccyx and the last spinous process of the sacrum (fourth segment). Occasionally the sacral ligament is partially ossified and the hiatus is sufficiently small to prevent entrance of the needle.

Rarely a hypertrophic intervertebral disc is found between the third and fourth sacral segments which by protrusion into the sacral canal may obstruct the passage of the needle. The caudal end of the dural sac usually ends between the first and second sacral segments, occasionally extending as low as the level of the junction of the second and third segments. This point averages 6 to 9 cm. from the sacral ligament. In one case it was only 4 cm. Allowing for the thickness of the soft parts overlying the sacral ligament, a needle may safely be inserted 5 cm. without fear of entering the dural sac.

When 20 c.c. of methylene blue solution is injected into the cadaver the sacral canal is filled but without tension. The second, third, fourth, and fifth sacral nerves are bathed in the solution as they pass through the canal. Thirty

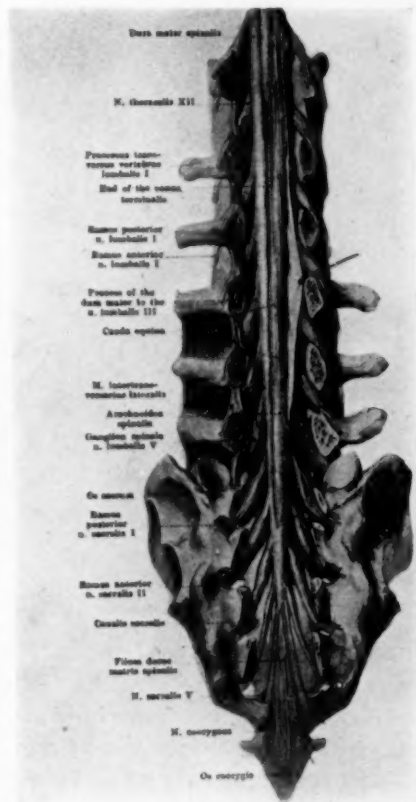


FIG. 2.—Spinal cord and membranes.

c.c. of fluid in the average case fills the caudal canal under slight tension and the injection fluid passes out about 3 cm. along the nerve roots of all the sacral nerves and occasionally the last lumbar, 45 c.c. of fluid reached the level of all the lumbar nerves and permeated out onto the nerve sheaths 3 to 5 cm. When 60 c.c. were employed the lower 3 to 6 dorsal nerve root sheaths became injected, 90 c.c. caused permeation of all the dorsal nerve sheaths. In all the experiments the dura about the cord was stained from

three to five inches above the level of the permeation of the nerve sheaths. In four cadavers in which 120 c.c. were injected, the solution permeated the nerve sheaths as high as the second or third cervical. It should be emphasized that in none of these experiments did any of the fluid enter the dural space despite the force required to inject such quantity. Therefore, it would seem that the danger of producing spinal or intradural anaesthesia is quite remote if proper technic is adhered to, and also that a rather high level of anaesthesia should obtain when 60 c.c. or more are injected.

Technic or Injection.—Certain details must be carefully adhered to and failure to comply with these

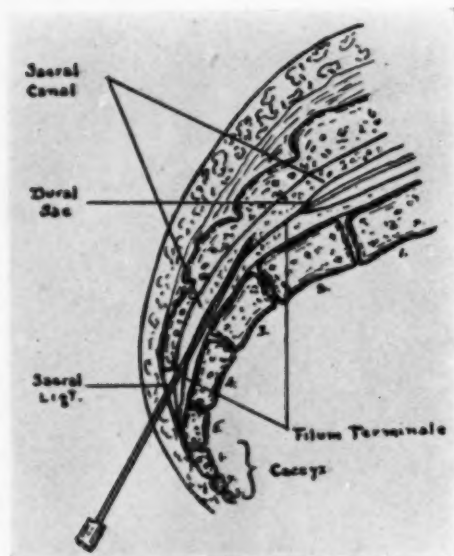


FIG. 3.—Direction and course of needle.

courts disaster. Unless contraindicated, a preliminary injection of hyocin gr. 1/150, morphine gr. 1/6 and atropine gr. 1/150 is administered 45 minutes beforehand. The mild twilight usually obtained is a distinct adjuvant, especially in neurotic types. For the sacral injection, the patient lies prone with a pillow under the hips. The skin area is iodinated and the sacral hiatus palpated. A few minims of 2 per cent. novocaine solution anaesthetizes the overlying skin and sacral ligament. The spinal puncture needle (3 inches in length, gage 20) with stylet *in situ*, is first passed through the skin and ligament at right angles about .5 cm. below the apex of the hiatus. As the needle passes through the ligament, a peculiar snap is felt, much the same as in performing lumbar puncture. The shoulder of the needle is then depressed until the needle is parallel to the long axis of the canal. No further obstruction is encountered if the needle is properly directed in the canal, and with very slight force it is readily insinuated for one and one-half inches.

Any obstruction during the passage of the needle connotes an improper plane of insertion and by slowly elevating or depressing the shoulder, a proper entrance should obtain. The stylet is then withdrawn and if no blood or spinal fluid escapes (the latter has not occurred in this series) 30 c.c. of freshly

SACRAL ANÆSTHESIA

prepared 2 per cent. novocaine in normal saline solution is *slowly* injected. The addition of 5 minims of 1-1000 adrenalin hydrochloride to the above solution prevents an over-rapid absorption of the novocaine. It should be remembered that novocaine injected into the sacral canal of dogs has been proven much more toxic than when injected intramuscularly. Some authors recommend the addition of other salts to the novocaine solution, *viz.*, sodium bicarbonate, potassium, or sodium sulphate, *et cetera*, claiming that such mixtures produce more lasting anæsthesia. In this series at first the following solution was employed:

Sodium bicarbonate	0.15 gm.
Sodium chloride	0.10 gm.
Novocaine	0.60 gm.
Water	30.00 c.c.

However, in over 80 cases freshly prepared sterile 2 per cent. novocaine solution in normal saline was employed to each 30 c.c., of which was added 5 minims of adrenalin. This solution, so simple of preparation, is quite as satisfactory as the one with sodium bicarbonate. It is important to inject the solution slowly and no resistance is offered except to the last few c.c. of injection. The writer feels this slight resistance to the last few c.c. indicates that the canal is quite completely filled and in many cases where no resistance was encountered, a few additional c.c. of either novocaine solution or simply normal saline were injected until some resistance was felt. More complete anæsthesia resulted with this addition to the usual technic. The patient sometimes notes a sense of fullness or weight in the sacral region during the injection, but usually nothing is complained of. If the patient experiences pain, the technic is faulty. At the completion of the injection, the needle is withdrawn and a drop of collodion is placed over the puncture site. The patient then sits up, that gravity may aid in holding the fluid in contact with the sacral nerves.

The period of onset, the area of distribution and the intensity of the anæsthesia show considerable variation. Anæsthesia usually begins about the anal region within five minutes. When complete anæsthesia obtains there is relaxation of the sphincter ani with an area of anæsthesia covering the sacrum, buttocks and inner thighs as represented in Fig. 4. The anterior urethra is anæsthetized in about 10 to 12 minutes, the meatus, internal sphincter, bladder and prostate requiring about 20 minutes. In the female the perineum, labia majora, vagina, cervix and urethra are anæsthetized in about 15 minutes. The clitoris and labia minora usually retain sensation. Occasionally only partial anæsthesia occurs. In such cases a second injection of 10 to 20 c.c. is perfectly safe and usually insures complete anæsthesia.

The duration of complete anæsthesia generally exceeds two hours. Often it requires forty-eight hours for full restoration of sensation and this partial prolonged anæsthesia may insure a painless convalescence. Some of the rectal cases felt they had not been operated upon.

The dangers of sacral anaesthesia seem practically nil if proper technic is employed. Three patients in this series complained of intense headache immediately after the injection. All were promptly relieved by sitting up. Only one patient, a drug addict, had vertigo. Several patients complained of slight palpitation and a few presented some pallor. These symptoms were mild, transient and never alarming. A few cases have been reported where

the needle has been broken off in the canal. With good needles and stylet *in situ* this should not happen. A colleague had an extensive infection of the back muscles from possible puncture of the rectum. No fatalities, palsies or late untoward results have been reported where proper technic has been adhered to.

All observers report some percentage of failures. In this series of 120

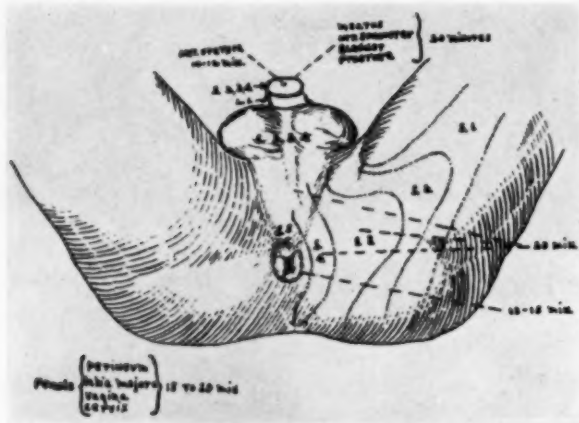


FIG. 4.—Time and distribution of anaesthesia.

cases there were 12. In 5 of these cases poor anaesthesia resulted and in 7 no anaesthesia (10 per cent. failures), in 10 cases (8 per cent.), a second injection was required to produce satisfactory anaesthesia. No complications occurred.

In 3 of the 12 failures by the caudal bloc a successful anaesthesia was obtained by transsacral injection. The following operations were performed:

TABLE I.
Case Records

Surgical condition	No. of cases	Average amount of injection	Time elapsed before anaesthesia was complete	Satisfactory anaesthesia	Failures
Hemorrhoids.....	65	31 c.c.	22 min.	61	4
Rectal polyp.....	1	25 c.c.	20 min.	1	0
Condylomata.....	2	30 c.c.	20 min.	2	0
Ischio-rectal abscess.....	6	32 c.c.	21 min.	5	1
Stricture of rectum.....	1	30 c.c.	20 min.	1	0
Anorectal fistula.....	20	31 c.c.	22 min.	17	3
Perineorrhaphy and trachelorrhaphy.....	4	33 c.c.	22 min.	3	1
Cystoscopy.....	4	30 c.c.	20 min.	4	0
Circumcision.....	3	30 c.c.	20 min.	2	1
Prostatectomy (perineal).....	2	40 c.c.	25 min.	1	1
Prostatectomy (supra-pubic).....	4	30 c.c.	20 min.	4	0
External Urethrotomies.....	8	31 c.c.	22 min.	7	1
Total.....	120	31 c.c.	21 min.	108	12

(1) Supra-pubic infiltration with 2 per cent. novocaine.

(2) Three caudal bloc failures were successfully anaesthetized by trans-sacral conduction.

CONCLUSIONS

(1) Sacral anaesthesia if properly administered is a safe procedure and should not be confounded with spinal anaesthesia.

(2) The motor nerves are not affected and the three lower sacral sensory nerves are those chiefly anaesthetized by conduction.

(3) With proper technic successful anaesthesia will result in the majority of cases. Failures grow less as one becomes more experienced.

(4) It would seem that sacral anaesthesia is deserving of more general application in rectal, genito-urinary and perineal surgery.

(5) One should be familiar with the technic of transsacral conduction in case of failure of the caudal bloc.

Indebtedness is due Dr. John M. O'Connor for his kind assistance in the cadaver experiments, and for administering several of the sacral injections.

INSTRUMENTARIUM FOR LOCAL ANÆSTHESIA

BY WILLIAM R. MEEKER, M.D.
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FROM THE SECTION IN ANÆSTHESIA OF THE MAYO CLINIC

As in all other surgical procedures, satisfactory work in local anæsthesia cannot be performed with unsuitable instruments. It is not at all necessary to

have a complicated outfit for the application of the various methods of local anæsthesia. All that is essential is the proper supply of needles and syringes.

In the selection of a syringe, the best make will usually be found the cheapest in the end. A syringe that leaks, or in which the plunger fits too tightly, should be discarded. The plungers of many syringes jam so tightly into the barrels that a certain amount of rotation is necessary in order to make the plunger advance. Such a manœuvre necessitates grasping the syringe with both hands, a procedure which interferes with the accurate control of the needle point. If the piston does not work smoothly within the barrel, the solution will be expelled unequally and cause pain by the sudden dilatation of tissues. The most common fault of syringes is that the barrel differs in calibre in different portions. In the narrow portions, the piston advances

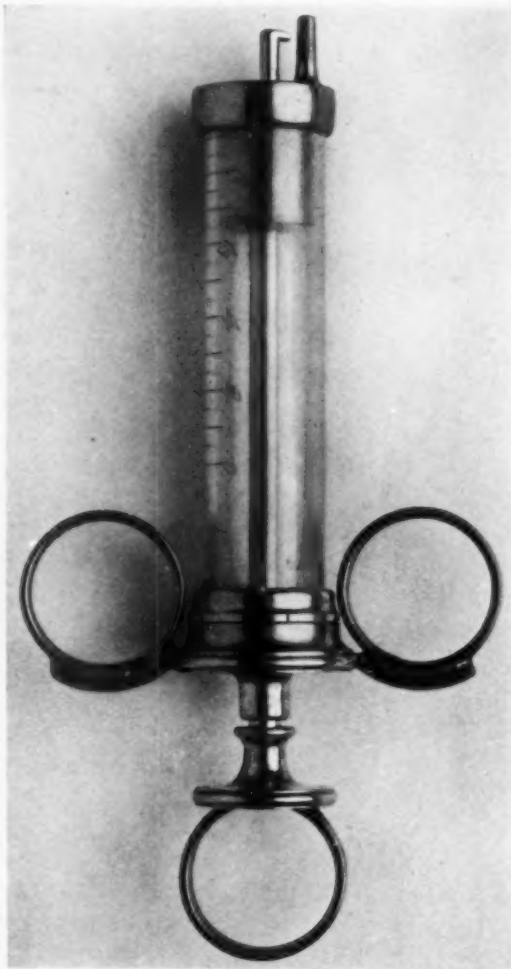


FIG. 1.—Labat's syringe, modified by the addition of three rings for the hand grasp.

with difficulty, while in the wider parts it permits the fluid to leak back.

The syringe should be simple in structure so that it will not get out of order and may be easily sterilized, either by boiling or by immersion in antiseptic solutions. All washers and packing are to be avoided, as they soon wear out and are unsanitary. An eccentric tip for the connection with the

INSTRUMENTARIUM FOR LOCAL ANÆSTHESIA

needle facilitates injection parallel with the surface of the skin and makes the manipulation easier in regions where the bony prominences of the body are in the way. Such an arrangement obviates the necessity of having the needle fixed at right angles to the barrel, as in the Hackenbruch syringe. A right-angled attachment interferes with delicacy of manipulation, and it is difficult to feel the location of the point of the needle, the location of which constitutes really the whole secret of local anæsthesia.

The needle should fit the tip of the syringe securely and fasten by means of a bayonet-lock attachment. The screw tip for attaching the needle is of no practical value since the needle very often must be introduced free from the syringe. Even when introduced attached to the syringe, as in terminal infiltration, it must be detached frequently for refilling of the syringe.

The proximal end of the syringe should be provided with an arrangement for making counter-pressure. Of these, rings are by far the best. A ring on the end of the plunger for the thumb and one on opposite sides of the barrel cover for the index and second fingers will enable the operator to aspirate or refill the syringe with one hand, and also give him better control of the syringe in progressive injection both during advancement and withdrawal of the needle.

The all-glass syringes have the disadvantage that they break too easily, especially the tip on which the needle fits. Such syringes fit the hand poorly, require the use of both hands for refilling or aspiration, and possess no locking device for attachment of the needle. The all-metal syringes, while very durable, possess the drawback that the operator cannot see the solution. It is thus impossible to eliminate the possibility of injecting the anæsthetic solution into the blood-vessels by aspiration. This feature is not of great importance in terminal infiltration because the needle is kept constantly moving while the injection progresses. In nerve block and sacral anæsthesia, however, aspiration is of greater value.

The most desirable syringe is one with a metal piston and glass barrel with metal mountings. The Record syringe does not fulfill the requirements

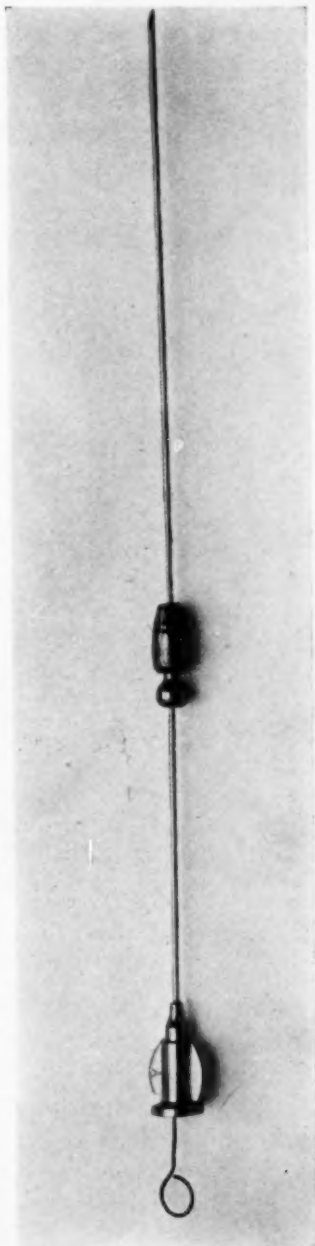


FIG. 2.—A 15 cm. needle showing the use of the anchor from a tie pin to mark depth, as in splanchnic nerve block.

mentioned. It is too short and thick, difficult to grasp, and contains no arrangement for making back pressure. In our experience the Labat syringe, made by Gentile and Company, of Paris, most nearly fulfills all requirements of a syringe for local anæsthesia. Of 10 c.c. capacity, it is large enough to

obviate the necessity of frequent filling and at the same time not large enough to be cumbersome. It is short enough when filled so that the thumb can be conveniently brought behind the plunger to force out the solution without grasping the syringe with both hands. The drawback of higher cost is easily overcome by the excellent workmanship, durability and smooth running qualities. It is provided with an eccentric tip and locking device for needles. With the aid of Mr. George Little, instrument-maker of the Clinic, this syringe has been modified by the addition of three rings for the hand grasp (Fig. 1). This makes possible aspiration and refilling of the syringe with one hand and enables the operator to manipulate it more deftly, especially in fanwise injections, and in the more inaccessible locations of the body.

Of no less importance than the syringes are the needles. These must be as fine as their stability will permit, thus minimizing the pain caused

by their passage through the tissues. With a small needle an injury, such as the unintentional pricking of a blood-vessel, will not be of serious consequence. Needles should be slightly flexible but not easily bent. There should be an assortment of different lengths for the different anæsthetic procedures. The beginner is likely to underestimate the depth of nerve trunks and tissue planes and use a needle too short to reach the sensitive area.

The material of which the needles are made should be, first of all, such that they will maintain a sharp cutting edge. For this reason, steel needles have been found to be the best. Needles need not necessarily withstand sterilization in a flame, as sterilization is more easily and thoroughly accomplished by boiling. Platinum and platino-iridium needles are too costly, bend too readily, and become blunt too easily. Tempered gold needles possess the same disadvantages. They should be provided with a bayonet-lock which will fasten

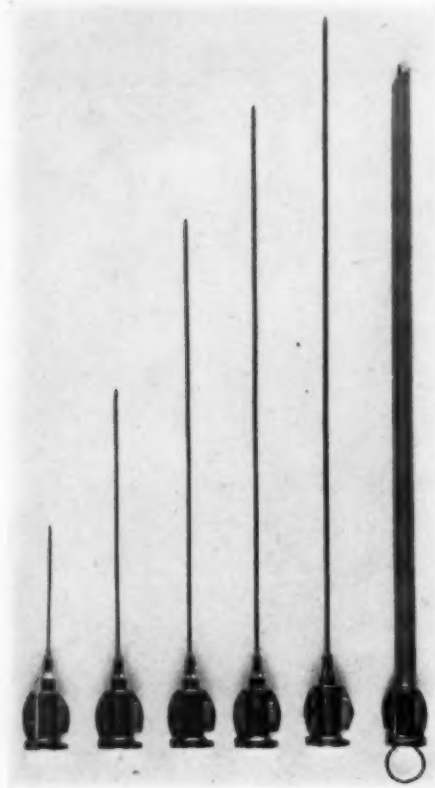


FIG. 3.—Labat's regional anæsthetic needles provided with special bayonet-lock hub.

INSTRUMENTARIUM FOR LOCAL ANÆSTHESIA

on the tip of the syringe by a quarter turn rather than threads for a screw tip, which requires many turns before the connection is secure.

Special needles have been devised for special purposes. Curved needles for periprostatic infiltration or injecting around the base of tumors are superfluous. They are expensive, not readily obtainable on the market and easily broken. Needle holders, needles with a graduated scale and appliances for marking the depth to which the needle is passed are unnecessary. A device for marking depth much superior to the customary piece of cork is the fastener which anchors the tie pin in a necktie (Fig. 2). This device will fit the average-sized needle equally as well as the tie pin and is valuable in estimating the depth in splanchnic nerve block.

Insulated needles certainly rank lowest in value among special devices. These needles, insulated everywhere but at the tip, are inserted to the approximate location of a nerve trunk then connected with a dynamo. When the non-insulated needle point comes in contact with the nerve, the electric discharge causes a contraction of the muscles supplied by the nerve, or a paræsthesia along the course of a sensory nerve. Obviously the disturbance to the patient is great and the method tedious. An accurate knowledge of anatomy would eliminate the necessity of such a procedure. The beginner will certainly do well not to attempt this method in operations on his friends.

The needles which most nearly fulfill the requirements of local anæsthesia are those sold with the Labat syringe (Fig. 3). These needles are made of an excellent quality of cutting steel, are nickel-plated, semiflexible, of various sizes, and as thin as possible in proportion to the length. Each needle has a bayonet-lock at the hub and is equipped with a metallic shield to protect the point. With careful cleansing these needles can be used repeatedly, and when slightly damaged may be restored by polishing on fine emery cloth and sharpening on a hard honing stone. The spinal puncture needle is made of a nickel alloy which will bend but not break. It is more useful in spinal and sacral anæsthesia than a steel needle, as there is no danger of breakage (Fig. 4). This lighter, more delicate needle is preferable to the heavy spinal trocars which are usually out of balance because of the heavy heads.

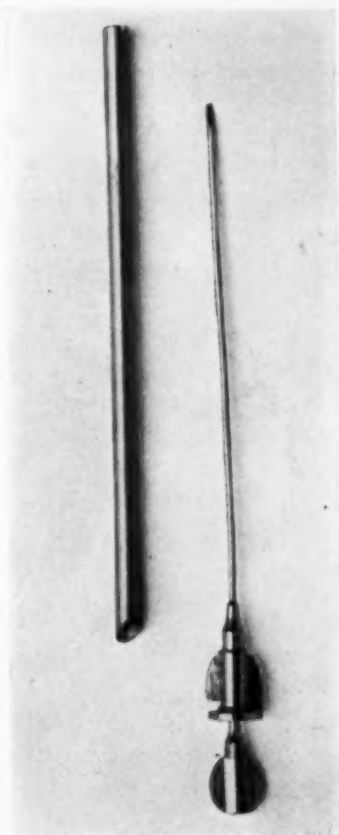


FIG. 4.—Nickeloid needle for spinal puncture and caudal anæsthesia.

The last five years has witnessed the invention of several self-filling syringes, for all of which it is claimed that they greatly facilitate the employment of local anæsthesia. It has been my privilege to use most of these instruments, at least those advertised in the more prominent journals, and it seems doubtful whether local anæsthetic procedures, except perhaps, infiltration during operation, are at all enhanced by their use. In nerve block and other methods in which the needle must be inserted detached from the syringe they are of no value. The principal advantage is that by means of a one-way valve attached to a rubber tubing running to the receptacle of anæsthetic solution, repeated injection can be performed without detaching the needle for refilling the syringe. It has been my experience that most of these instruments are hard to manipulate, easily get out of order, and that often the one-way valve will not work, so that the solution is forced back into the container. Instruments that are equipped with but a single valve, do not expel the air from the tube efficiently and more or less air continues to collect in the syringe as the plunger is withdrawn in refilling. To be at all efficient, such syringes should be provided with both an inlet and an outlet valve, so that it may be filled without the necessity of having the needle point buried in the tissues, and all air may be excluded from the tube before the injection is begun.

The self-filling syringe which comes nearest satisfying all requirements for local infiltration is the Livingston. It is equipped with a double valve, is all metal, and contains no washers, springs or packing in the valves. It is smooth working, and provided with rings for the hand grip. A few strokes of the plunger excludes all air from the tubing and it is impossible to force novocain solution back into the container. It requires but little care and can be easily sterilized.

A very serious drawback, however, is the needle. The needles are coarse, stiff and short, resembling spinal trocars rather than needles appropriate for local anæsthesia. They are also threaded and screw onto the tip of the syringe. This feature has been improved by a device enabling the Labat needles to be used. Again with the aid of Mr. Little, the end of a broken Labat syringe was ground down and threaded to fit the Livingston syringe (Fig. 5), thus discarding the coarse stubby needles, with which the syringe is originally furnished, and at the same time providing a bayonet-lock. This improved outfit, in my experience, is the most efficient of all self-filling syringes.

Pneumatic injectors as substitutes for syringes have also been devised at various times. The principle of such instruments is that of a charged cylinder. The novocain solution is placed in a cylinder under pressure and is led away by a hollow wire or tubing to a needle, the only method of controlling the flow of the solution being by means of a stopcock. Such instruments must,

INSTRUMENTARIUM FOR LOCAL ANÆSTHESIA

of necessity, be complicated, cumbersome, and difficult to sterilize. They usually require considerable work to assemble, which means that in most cases the adrenalin cannot be added to the novocain solution just before injection.

Obviously, such an apparatus is more appropriate for infiltration than other local anæsthesia procedures. In nerve block, when the needle is introduced separately and when small definite quantities of solution must be injected slowly, these instruments are entirely unsuited. The fact that the operator does not furnish the force for the injection, and that the pressure in the cylinder is the same in dense as in loose tissues, leads to an unequal distribution of solution. The loose areolar tissues offering less resistance to injection, receive massive œdematization where indeed least solution is required.

The resistance to injection sensed by the operator, when

employing a syringe, is often a very valuable indication as to the position of the needle point. The claim of an advantage in the pneumatic injector of not tiring the muscles is a very doubtful one. It is difficult to understand how an operator physically able to complete a major operation would be fatigued by the effort expended in manipulating a smooth working syringe. In my experience pneumatic injectors in no way simplify the employment of local anæsthetics, but represent rather the employment of a complex clumsy apparatus for the performance of a simple task.

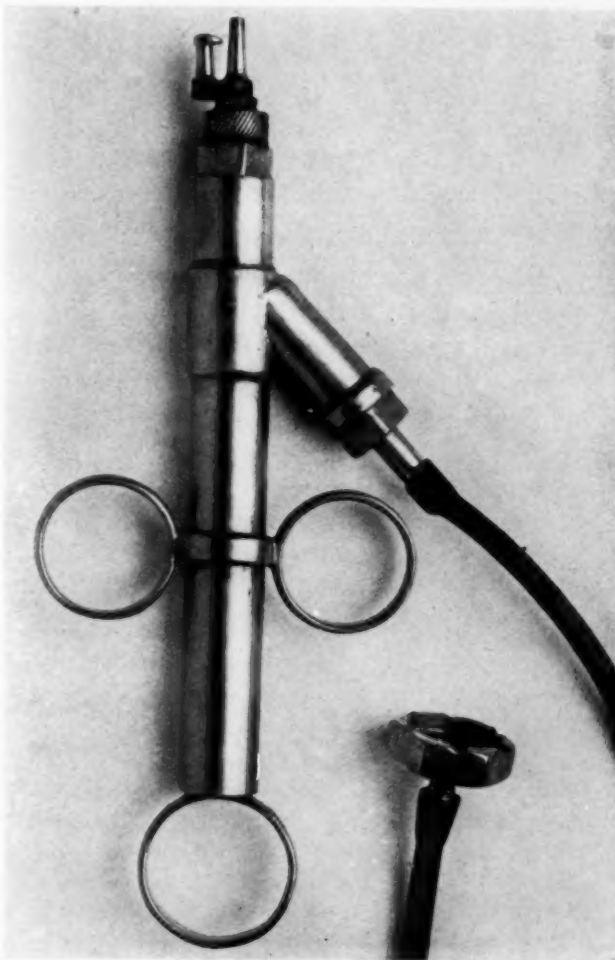


FIG. 5.—The Livingston double valve syringe with an adaptor made from the tip of the Labat syringe. This device makes possible the use of the Labat needles, with an automatic self-filling syringe.

TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting Held October 1, 1923

The President, DR. JOHN H. JOPSON, in the Chair

BRACHIAL PLEXUS ANÆSTHESIA FOR AMPUTATION OF FOREARM IN A PATIENT WITH ADVANCED PHTHISIS

DR. ASTLEY P. C. ASHHURST reported the case of a woman, twenty-two years of age, who came under his care in the Orthopædic Hospital in March, 1922. She was suffering from an advanced stage of bilateral pulmonary tuberculosis, and had developed about eighteen months previously, tuberculosis of the left wrist joint, following about six months after a severe sprain. The wrist lesion had advanced rapidly, an abscess had broken more than a year previously, and four sinuses were present when first seen. The hand had been utterly useless for a year, and was constantly painful. The patient asked that it be amputated, even before the surgeon had an opportunity to explain that this offered the only chance of relief.

The pulmonary condition contra-indicated a general anæsthetic by inhalation, and as the patient was too weak to sit up, in the approved fashion for injecting the brachial plexus subcutaneously, the plexus was exposed March 25, 1922, by local infiltration anæsthesia with novocain one-quarter per cent. (morphin and atropin having been given hypodermically): incision 5 cm. long above the left clavicle; fat dissected; omohyoid drawn upward; internal jugular vein retracted medially. Brachial plexus exposed, and six hypodermic syringefuls (about 12 c.c. in all) of novocain one-quarter per cent. were injected among its trunks, infiltrating the surrounding fascia. The wound was closed with buried and skin sutures. The time required for exposure, injection, and closure of the wound was ten minutes.

One-half hour later, an Esmarch band was applied over a towel below the deltoid muscle, after the arm had been held elevated for a period of three minutes. Amputation was then done at the middle of the forearm. The entire procedure was painless, except retrenchment of the median nerve, which had been haggled at its primary division. A momentary sharp pain was experienced when it was drawn down and again divided. The stump was closed with buried and superficial sutures without drainage. The time required for the amputation was 15 minutes.

The patient promptly began to improve after the removal of the suppurating limb; she was able to resume her housework, but died of phthisis about a year later.

EXCISION OF A CERVICAL RIB

EXCISION OF A CERVICAL RIB

DOCTOR ASHHURST presented a woman, twenty-five years of age, who was admitted October 5, 1922, to his service at the Episcopal Hospital. Her chief complaint was pain in the left shoulder, arm and neck. Her previous personal history was irrelevant. In June, 1922, a friend called her attention to a swelling in the left supraclavicular fossa. She came to the Surgical Dispensary of the hospital on June 26, where Doctor Brown suspected the existence of a cervical rib, but when X-rays were made of her neck, neither an antero-posterior nor a lateral view showed any abnormality. In July, she began to experience pain in the arm and shoulder, and the left side of the neck felt stiff and tight from the ear down. She thought the swelling had been increasing in size, and her own physician told her the same.

Examination was negative except for the neck. In the left supraclavicular fossa, inspection showed a swelling about 2 cm. above the junction of the middle with the outer third of the clavicle. Above this swelling, the jugular vein was visibly distended. On palpation the mass was found to be dense, like bone, and was round and smooth, the skin not adherent. Two bony processes extended from this mass—one went upward and mesially, and did not seem to be attached to the lower process which ran downward and mesially to disappear beneath the middle of the clavicle. A diagnosis of cervical rib was made and the patient referred for further X-ray examination by Dr. R. S. Bromer, who found (Plate 14, 143) a definite left cervical rib, which at the first X-ray examination had been hidden by the shadow of the first rib. The cervical rib ran from the left transverse process of the seventh cervical vertebra to a facet on the anterior surface of the first rib. The right transverse process of the seventh cervical vertebra was abnormally large.

Operation, October 7, 1922, intrapharyngeal ether. An incision 12 cm. long was made in a skin fold about 2 to 2.5 cm. above the left clavicle. The external jugular vein was doubly ligated and divided, and the posterior margin of the sternomastoid drawn forward. The omohyoid muscle was divided. The subclavian artery lying high in the neck, and running downward almost parallel with the usual course of the common carotid, was identified easily by the fact that pressure on it checked the radial pulse. It was dissected free and drawn forward. The brachial plexus was dissected free and drawn backward. Between these two important structures the most prominent part of the cervical rib was identified, covered with cartilage. The rib was thence traced backward almost to the vertebral column, and there divided with bone forceps. Next, by retracting the subclavian artery laterally over the cervical rib, the anterior end of the latter was found inserting into the first rib, beneath the clavicle, near the sternum. The lung was in plain view through the transparent pleura. It was impossible to distinguish between the lower border of the cervical rib and the upper border of the first rib. So, to make certain that all the cervical rib was removed at its anterior end, the upper border of the first rib was resected also with forceps, and the two were removed in one piece. It was then found that a movable joint was present between the end of the cervical rib

and the upper border of the first thoracic. As the rib was withdrawn from the wound, there was a sound as of air entering the pleural cavity, but no symptoms occurred. The rib was removed with its periosteum intact. The platysma and skin were closed separately. The operation lasted one hour.

There was no pain at all from the time of the operation, and at no time were there any evidences of motor or sensory disturbances from nerve injury. Doctor Ashhurst said he was rather surprised at the entire freedom from nerve lesions, as Dr. Alfred S. Taylor, who had reported a number of operations for cervical ribs, and who was quite accustomed to doing operations on the brachial plexus, had found them of nearly constant though usually temporary occurrence after the removal of cervical ribs. Doctor Taylor (N. Y. State J. of Med., 1922, vol. xxii, p. 97) writes: "The operation is difficult, is apt to be quite bloody, and is frequently followed for a varying period of time by more or less paralysis of the extremity which results from operative traumatism to the plexus. Were it not for these objections," continues Doctor Taylor, "which a review of the literature shows to be very real, there could be no question that operative treatment should be the method of choice." Doctor Taylor adds that leaving the head of the rib *in situ* has seemed to cause no late disturbance, but that it is important to remove the rib right up to the head because there might otherwise be continuing irritation of the seventh root. He points out that the shorter the rib, the more apt is such irritation to occur, because the very rudimentary ribs have their broadest surfaces in the coronal plane, with sharp borders above and below. In such short ribs, he approaches them from the lateral or posterior border of the brachial plexus; in longer ribs he excises the anterior portion first from the median side of the plexus, and then goes lateral to the plexus to remove the stump which remains.

It is true that in the present case the vertebral end of the rib had not been completely removed, a small segment still being articulated with the transverse process of the seventh cervical vertebra; but this was well above the region where the nerve caused pain from pressure on the brachial plexus.

SPONTANEOUS (?) FRACTURE OF CLAVICLE; RESULTING CALLUS MISTAKEN FOR TUMOR

DOCTOR ASHHURST also presented a boy, seven years of age, in whose right clavicle a lump had been first noticed on August 26, 1922. There was no history of any injury and there had been no disability at any time. The patient was sent by Dr. A. V. Moschcowitz of New York, with a tentative diagnosis of malignant growth, with pathological fracture.

Examination on September 5, 1922, showed a perfectly healthy and unusually intelligent boy, physical examination of whom was negative except for the lump on the right clavicle. This was situated about 3 cm. from the sternal end, was prominent, about 2 cm. in diameter, attached to the clavicle, and of cartilaginous consistency, not bony hard.

CERVICAL LYMPHADENITIS SIMULATING A TUMOR

It was tender on firm pressure. Skiagraphs which he brought with him, made in New York, showed a fracture (pathological?) of the clavicle, with rather spotty looking bone. The callus or tumor did not show in the skiagraphs.

X-rays made September 11, 1922, at the Episcopal Hospital, by Dr. R. S. Bromer, showed callus forming around the fracture in fusiform shape, in excess of the normal for fracture repair, and greatly in excess of the normal for any fracture without displacement and apparently subperiosteal. Doctor Bromer, however, did not see anything which indicated the presence of a tumor.

Operation September 12, 1922.—An incision 12 cm. long was made over the right clavicle, detaching the pectoralis major, sternomastoid, and subclavius muscles, without opening the periosteum. The sternoclavicular joint was opened, and the clavicle was raised, and divided at the junction of the middle and outer thirds by means of bone forceps, and the fragment was removed. A second incision, 15 cm. long, was made over the right fibula, the middle third of this bone being exposed posterior to the peroneal group of muscles. The periosteum was reflected, and an aperiosteal transplant, 7.5 cm. long, was removed by bone-cutting forceps, and the leg wound closed. The transplant was inserted in the defect in the clavicle, its sternal end being fixed to the sternum by No. 2 chromic gut sutures passed around the entire transplant and perforating the sternum. The remainder of the transplant was imbedded beneath the sternomastoid and pectoralis major muscles. Its distal end did not quite touch the scapular fragment of the original clavicle as the patient lay with his shoulder stretched over a sand bag. After closure of the incision a T-shaped splint was applied to the back, holding both shoulders back against the transverse bar.

September 18. The patient was discharged from the hospital.

October 5. The T-splint was discontinued, as the clavicle seemed to be united, and its scapular end in apposition with the transplant.

October 1, 1923. Thirteen months since operation. The right clavicle is less than 0.5 cm. shorter than the left. Its sternal end is firmly attached, but at the junction of the transplant and the scapular end there is only fibrous union. There is no pain or tenderness and no disability of any kind.

Pathological Report.—The specimen, consisting of the inner two-thirds of the right clavicle, was sawed in two, lengthwise, exposing a line of fracture, with recent callus forming in excess about it. Microscopical examination by Dr. C. Y. White failed to show any evidence of tumor formation; merely normal bone with a line of cartilage traversing it, as might be seen in any uniting fracture.

CERVICAL LYMPHADENITIS SIMULATING A TUMOR

DOCTOR ASHHURST related the history of a man, thirty years of age, who came under his care in the Episcopal Hospital in October, 1922. His family and previous histories were negative, and his chief complaint was a lump on the left side of his neck, and stiffness of the neck. This lump was first noted about the first of August, 1922, and was then

about the size of a pea. By the middle of September, it had grown so large that he applied to the Frankford Hospital, where he was seen by Dr. Chas. F. Nassau. Doctor Nassau, according to the patient, made a diagnosis of malignant tumor, and recommended that no operation be attempted. Since that time the swelling had continued to increase in size. Later the swelling was submitted to an exploratory incision, nothing but blood being obtained. At present there is considerable aching in the region of the tumor, and recently the patient had had numerous attacks of vertigo. His best weight had been 135 pounds (61.5 kg.); on admission he weighed 120 pounds (54.5 kg.).

Examination showed a healthy adult male. His scalp, eyes, ears and nose were normal. His neck presented in the left submaxillary region a mass which extended from below the ear half-way to the clavicle protruded above the level of the mandible, and extended backward to the posterior border of the sternomastoid. This mass was firm and elastic to the touch and in its upper part, toward the mandible, gave an indistinct sense of fluctuation. The skin was not adherent except at the site of the exploratory incision. There was no œdema, and only slight heat. The mass was movable slightly antero-posteriorly, and less freely up and down. The deep cervical lymph-nodes were palpable on both sides, and were larger on the right than the left side. No submental nodes were palpable, nor were the right submaxillary lymph-nodes. The temporal pulses were equal. There was no indication that the mass was an aneurism.

The thorax and abdomen were negative. The epitrochlear and inguinal lymph-nodes were palpable on both sides of the body.

In view of Doctor Nassau's opinion that the mass was malignant, a number of consultants were asked to examine the patient. Doctor Nicholas, making a dental examination, reported that all the remaining teeth were in rather good condition except for stains and accretions; he found no evidence of a possible focus of infection. Doctor Collins, making an examination of the throat, nose, and ears, reported them as negative for possible source of infection. Dr. H. C. Deaver, making a local examination, gave as his first diagnosis, *sarcoma*; as his second, *tuberculosis* of lymph-nodes. Dr. E. G. Alexander thought it was a growth of the lymph-nodes, of *sarcomatous nature*; but thought tuberculous infection must be considered.

Operation.—On October 14, 1922, operation was undertaken by Doctor Ashhurst with the diagnosis of tuberculous lymph-nodes; second choice of diagnosis, branchial carcinoma. The rapidity of growth (just over two months) indicated, he thought, an inflammatory rather than a malignant tumor; although the negative exploration, and the absence of any recognizable focus of infection, were rather in favor of a neoplasm. However, it was determined to conduct the operation as if the tumor were malignant. With the patient in the head high position, and the neck hyperextended over a sand bag, and under ether anæsthesia, an incision, 15 cm. long, was made along the anterior border of the left sternomastoid muscle, an island of adherent skin, including the cicatrix of exploration, being removed with the mass. The sterno-

RECURRENT KELOID OF BOTH EARS

mastoid muscle was cut across about 5 cm. above the clavicle, and the common carotid artery was temporarily occluded with Crile's clamp. The tumor was dissected upward from the internal jugular vein until the latter became so densely adherent that it was cut across and tied. The submaxillary salivary gland was removed separately from the tumor, to which it was not adherent, though inflamed. This gave better exposure beneath the floor of the mouth and pharynx where the tumor extended. A few discrete enlarged lymph-nodes around the edge of the tumor were also removed with it. The superior laryngeal, hypoglossal and vagus nerves were identified and preserved; the spinal accessory nerve was not recognized. The tumor was dissected up to the base of the skull, where, in freeing it from the upper end of the internal jugular vein, the tumor was accidentally opened, with the discharge of a little creamy yellow pus. The upper end of the internal jugular vein was ligated, the resected portion being removed with the tumor. The arterial clamp was then removed. Temporary occlusion of the common carotid certainly facilitated the dissection by rendering the field relatively bloodless. The platysma was closed with interrupted chromic catgut, and the skin with equisetene; a rubber tissue drain was left at the lower end of the incision. The man made an uneventful convalescence.

Pathological Reports (Dr. C. Y. White).—From the pus encountered during operation, a smear showed no organisms, and a culture gave no growth. A guinea-pig inoculated with the tissue failed to develop tuberculosis. Histological examination showed merely chronic inflammation of lymph-nodes without evidence of any specific change, tuberculous or other.

The patient was seen in May, 1923, seven months after operation. He carried his head with the chin turned a little toward the left. At present, one year after operation, he carries his head straight, and is in good general health. The cicatrix is linear and supple. Just posterior to the scar at its upper end there is one enlarged lymph-node, about $\frac{1}{2}$ to 1 cm. in diameter, and slightly tender.

DOCTOR NASSAU remarked that although Doctor Ashhurst in his history of this man had traced this case as far as Frankford Hospital, he did not go back far enough. He had an epithelioma of the lip excised at Jefferson Hospital three years before he came to Frankford Hospital, so that there was every reason to assume that the enlargement in the neck was evidence of a malignant growth, a case of recurrent carcinoma. They advised X-rays, preliminary to radical operation, but the patient refused to have this done, left the hospital and did not return. As Doctor Ashhurst notes, he has another enlarged gland in his neck, posterior to the recent dissection. It would seem as though the diagnosis of malignant growth of the neck was justified, even though the pathological examination did not find any area of malignancy.

[POSTSCRIPT.—Reëxamination of the patient showed a small scar on the right lower lip; this the patient had tried to conceal for fear if it were seen, no operation would be done. He acknowledged having been operated on by Doctor Neilson in March, 1920, in the Episcopal Hospital, at which time he gave an assumed name. The records show that

a small growth, which had then been present for six or seven years without any change in its character, was excised. Doctor Neilson's diagnosis was papilloma. The specimen was not sent to the laboratory for microscopic examination. The patient states he was never treated in the Jefferson Hospital.

The patient has promised to return after Christmas for excision of the palpable but indolent node, still present in the left neck, and a further report will then be made to the Academy. A. P. C. A., December, 1923.]

RECURRENT KELOID OF BOTH EARS

DOCTOR ASHHURST presented a negress, forty years of age, who came under his care at the Episcopal Hospital in September, 1921. Keloids had developed in the lobule of each ear about twenty years previously, very soon after puncture for ear-rings. The keloids grew slowly, but became so large that she had submitted to an operation elsewhere in 1917. The keloids began to return almost at once, and were now larger than ever before. They formed firm pendulous masses (about 10 by 5 by 8 cm. in size) attached to the lower half of each auricle. (Fig. 1) and apart from the conspicuous deformity, which she concealed by wearing a close-fitting cap covering the ears and tumors, they also incommoded her by their weight and size.

September 30, 1921, the keloid was excised from the *left* ear, leaving a defect about the size of the palm of the hand. The skin edges were undermined on all sides, thus exposing the platysma and fascia. A free transplant of fascia lata (about 8 by 5 cm. in size) was cut from the right thigh and inserted in the neck wound, being sutured with No. 00 chromic catgut to the platysma and fascia, well back from the skin edges. To close the skin a plastic operation was necessary. A flap was cut from the neck, with its base below and anteriorly, and the apex of the flap was inserted behind the auricle. In this flap were included the superficial fibres of the sterno-mastoid muscle. A small flap from the scalp had to be brought down to complete the closure above and behind the ear. The skin edges were closed with interrupted sutures of equisetene. The closure was smooth and without tension except at the lobule of the ear. This point subsequently became the seat of a slough, about 1.5 cm. in diameter. The rest of the wound healed properly.

November 1, 1921, the keloid of the *right* ear was excised in a similar manner, a free transplant of fascia lata (about 4 by 10 cm.) taken from the left thigh, being implanted, and a skin flap (about 5 by 10 cm.) being cut as already described from the neck, and turned up to cover the defect. Healing occurred without any slough, there being no tension on the suture line at any point.

Systematic exposures to the Röntgen-ray were given during the after-treatment by Dr. Ralph S. Bromer.

Photographs made one year after operation (Fig. 2) show no recurrence of keloid at all except just below the left ear, where tension was present and a slough separated. The patient's present condition, two years since operation, shows no further recurrence, except on the scalp back of the left ear, where there is slight keloid. The ear itself



Fig. 1.—a and b. Keloid of both ears, recurrent after operation four years ago. c. Scar of operation on left ear, twelve days before photo.

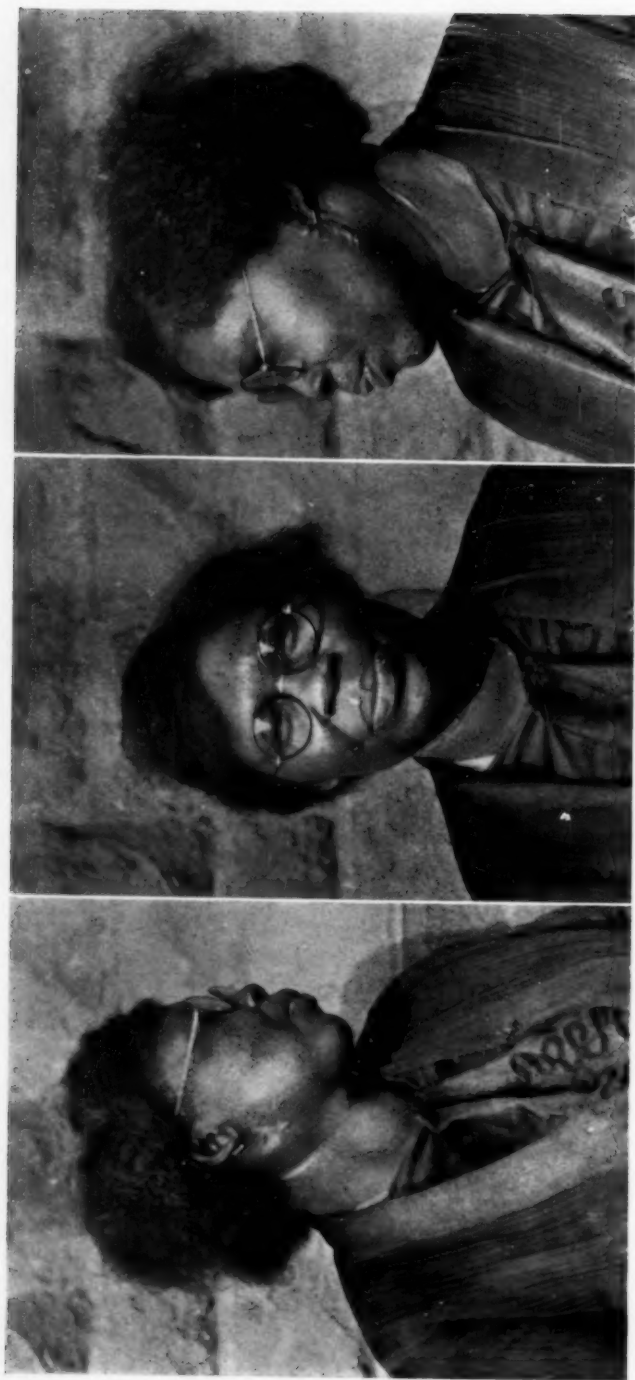


FIG. 2.—One year after operation for keloid of both ears; no recurrence at the end of the second year.

CARCINOMA OF THE SIGMOID

is normal. Whether this freedom from recurrence is to be attributed to the implantation of the fascial transplants, thus relieving the skin cicatrices of tension, as advocated by Freeman (Colorado Medicine, 1915, vol. xii, p. 79) or to the Röntgen-ray treatment, is problematical. Certainly it is well recognized that simple excision of keloids, without any other precautions, is nearly always followed by prompt recurrence; and it is further notable that both the incisions made in this patient's thighs have developed keloids, that on the left giving her pain at times. The left thigh keloid measures 1.5 cm. by 17 cm., and that on the right 1 by 16 cm. These skin wounds were made in the long axis of the limb, that is at right angles to the normal skin creases, but were under no tension when sutured. Yet they were over defects in the fascia lata, which could not be closed completely after removal of the transplants, and they were not subjected to Röntgen therapy.

DR. RALPH S. BROMER said that X-ray treatment is indicated in every case, except where the keloid is so large that all hope of reduction in size is impossible, owing to the extreme growth of the tumor. In such cases post-operative treatment after removal by the surgeon is the best method. In this case, 9 or 10 doses of X-ray were given in which the scar was screened very closely in order to protect the remainder of the skin. The keloid tissue certainly did not increase in size. However, in another case a small keloid of the neck, seen about two weeks after starting this one, after three treatments there was no apparent effect on the growth. This case was then referred to the surgical service and the growth was excised, fascia lata transplantation being used. After six or seven post-operative treatments the keloid recurred. Doctor McKee, of New York, has had much experience in these cases and finds very little difference between the use of radium and the X-ray, but finds the beta rays of radium very efficacious in the treatment of small keloids. Pfahler and Knox agree that after post-operative removal, treatment by radiation is always indicated. In case of small keloids radiation should first be tried.

DOCTOR DORRANCE said that in a patient at St. Agnes' Hospital who had large keloids on the chest, a test was made by applying X-ray to 1/3; radium to 1/3, and nothing to 1/3. After X-ray treatment and radium treatment of, he did not remember what exact dosage; they excised it three months later and the pathological report showed no difference between any of the three parts. After they removed it they did the same thing over again with no particular change. They thought, however, that the side to which radium had been applied had less scar.

CARCINOMA OF THE SIGMOID WITH PERFORATION OF THE CÆCUM

DR. EDWARD J. KLOPP presented a specimen obtained from a man aged fifty years, who was admitted to Doctor Gibbon's service at the Jefferson Hospital, September 12, 1923. He complained of pain and distention of the abdomen and constipation. His father died at sixty-seven of cancer of the rectum.

In November, 1922, he had a cough which lasted about three weeks; no hæmoptysis, nightsweats or pain in chest. All winter he felt weak and tired and began to lose weight. Had no nausea, vomiting, diarrhoea or increased constipation. About three months ago first noticed swelling of the abdomen which would appear and disappear. This has become worse until now it stays all the time. About six weeks ago pain gradually appeared and became fairly severe. He vomited only twice in last six weeks, rather copiously, a bitter, dark greenish material. Constipation began three months ago which later became very obstinate. At no time did he notice blood or mucus in the stools.

On examination the abdomen was found to be considerably distended, tympanitic, moderately tender over the right lower quadrant and no free fluid demonstrable. Transversely across the abdomen, immediately above the umbilicus and corresponding to the position of the transverse colon, was a mobile, fairly soft mass suggesting fecal accumulation.

Temperature, pulse and respiration were normal. He did not appear to be critically ill. Immediate surgical interference did not seem imperative.

At 4 P.M. of the following day he vomited, the abdominal pain was intense, the pulse could not be felt. There was no response to stimulation. He died at 8 P.M.

The autopsy made by DR. B. L. CRAWFORD revealed a general recent peritonitis due to a perforation of the anterior wall of the cæcum, in which part of the intestine was an area of necrosis.

The stomach and entire small intestine contained foul-smelling fecal material. The wall of the entire cæcum was dark green in color, the opening in the wall sharply defined, without any evidence of inflammation of the mucosa. No induration of the gut wall. The remaining portion of the large intestine was markedly distended with semisolid fecal material, down to the sigmoid, 30 cm. from the anus, where there was a definite constriction in the lumen of the gut; only with force could small quantities of fecal material be forced through. On sectioning the sigmoid, the constricted portion measured 2.75 cm. in circumference, a narrow portion of the gut wall is thickened and indurated.

The histologic diagnosis was adeno-carcinoma of sigmoid with metastasis to the regional and retro-peritoneal lymph-nodes. Acute fibrino-purulent peritonitis.

He presented this specimen not because cancer of the sigmoid is unusual nor that obstruction is infrequent, but because necrosis of the cæcum so far removed from the site of the obstructive lesion is uncommon. The necrosis probably was due to marked distention and weight of the heavy column of colon contents. One occasionally sees ulceration and perforation at site of malignant growth or near by on the proximal side when obstruction is almost complete and when the fecal matter is fairly hard, thus causing ulceration and possibly perforation.

Perforation apparently was not very sudden, evidenced by the closure of the opening by a coil of intestine and the absence of fecal material in the peritoneal cavity.

HYDRONEPHROSIS FROM KINKING OF URETER

DR. A. P. C. ASHHURST said that some years ago he had a patient who had an abscess around the cæcum, and came to the hospital very sick. The abscess was opened and drained, but the patient never got well and a fecal fistula developed. At autopsy a carcinoma was found at the hepatic flexure, entirely independent of the perforation of the cæcum, but which had caused the perforation, by back pressure from chronic intestinal obstruction. The carcinoma, however, was nearer the seat of perforation than it was in Doctor Klopp's case.

HYDRONEPHROSIS FROM KINKING OF URETER

DR. T. TURNER THOMAS reported the history of a man, forty-three years old, who three or four years ago, had a severe attack of abdominal pain in the right side of the abdomen and loin, and remained in bed three weeks. Last year he had another similar attack which kept him in bed five weeks. The pain bore no relation to meals. He never had any dysuria, incontinence, hæmaturia, or any trouble with urination. April 7, 1923, his last attack began when he became nauseated and vomited a few times. He has had no other gastric symptoms, no pain after meals, no gaseous or acid eructations, and his appetite has been good. He has had no dizziness in these attacks, no palpitation, cedema or other heart symptoms. He has not been jaundiced at any time. He was admitted to the Northeastern Hospital on April 7, 1923, the day on which this last attack began. April 9 the abdomen was opened by a right rectus incision. On introducing the hand into the abdomen for examination, an abnormal globular mass was discovered which appeared to be connected with the kidney. The abdominal incision was then closed and protected and the patient turned over into the prone position and the kidney exposed through the loin. It was delivered into the wound and the fluctuating mass explored by a needle and found to contain a fluid which was probably urine. It was then opened and found to be a dilated kidney pelvis.

The ureter immediately below the dilated pelvis was of about the normal calibre, indicating that there was an obstruction at the junction of the dilated and normal portions. It was concluded that there must be a kink here. No stone could be found in the pelvis and an ordinary (long) probe was passed down the ureter about 6 or 8 inches to where it crossed the iliac vessels and bent sharply downward into the pelvis without meeting any obstruction. In an effort to overcome the kink the ureter was divided longitudinally and an attempt made to suture this wound transversely. This was very difficult and resulted in the complete detachment of the ureter from the pelvis. The upper torn opening in the ureter was then anastomosed into the larger opening in the dilated pelvis by catgut suture, the effort being to overcome any further obstruction by uniting the small opening of the ureter all around to a larger opening in the pelvis, thus tending to hold the ureter wide open. This was accomplished fairly satisfactorily, the kidney was replaced in the abdomen, a split rubber tube with a gauze drain in it was introduced to the repaired pelvis and ureter and brought out of the lower angle of the wound, which was then closed in the usual manner. The patient was returned to the ward in a fair condition.

PHILADELPHIA ACADEMY OF SURGERY

April 10. The pulse which was about 60 before operation has gone up to 136, the temperature to 100.6. The abdomen is tense and tympanic and the patient breathes with difficulty. He is vomiting small quantities of a dark liquid, usually turning his head to one side to spit it out. He has not passed flatus, although peristalsis can be heard.

April 11. Same condition as yesterday, somewhat worse.

April 12. After an effectual enema to-day the abdomen became softer and the patient felt better.

April 14. The improvement has continued and to-day the patient is allowed soft diet. The dressings over the loin wound are dark from wound discharges, but have become dry, indicating that he has probably not been discharging urine from the wound. On the day following the operation the urine was dark colored, evidently from blood, indicating that he was already passing urine freely through the anastomosed ureter and kidney pelvis.

The patient continued to improve and was discharged April 25. At no time after the operation did he show any evidence of obstruction to the urine. He went back to work about four weeks later and has continued to do so since, according to his statement when last seen, about the middle of August, and by the statement since then by his physician, Dr. W. Drummond.

CHORIO-EPITHELIOMA OF THE UTERUS

DOCTOR THOMAS detailed the history of a woman, twenty-seven years of age, who was admitted to the Northeastern Hospital, July 29, 1923, on account of a metrorrhagia which had persisted for about ten weeks. Three years before she had experienced a similar trouble, which was relieved by a curettement. In the interval she had been perfectly well.

July 31. The cervix was widely dilated and the finger introduced, but could not reach the fundus nor feel anything pathological. The dull curette detected on the posterior surface of the uterine cavity near the fundus on the left side, a small, rough, gritty surface, the scraping of which produced a peculiar tissue, which was rather tough and fibrous and had a somewhat cauliflower appearance. To stop the free bleeding the uterus was irrigated with a hot solution and packed with sterile gauze, which was removed on the following day.

August 3. The pathologist, Dr. William Spaeth, reported that the specimen showed a chorioepithelioma.

August 4. A supravaginal hysterectomy with a bilateral salpingo-oophorectomy was performed. The specimen consists of the uterus, both tubes and ovaries. The uterus is about twice the normal size and is soft and boggy. Both tubes and ovaries show no abnormalities. Opening the uterus anteriorly there is found a reddish-blue mass situated on the posterior wall of the fundus, soft and friable and intimately attached to the uterine endometrium. It is about 3 cm. in diameter and spherical in outline. A section taken for diagnosis, upon microscopical examination, showed a cellular extension taking place in the blood sinuses and irregular masses of nucleated protoplasm formed by syn-

RAPID REGENERATION FOLLOWING FACIAL NERVE SUTURES

cidial cells. Many smaller cells resembling endothelial cells and some similar to lymphocytes are also present. In addition there is found some myxomatous degeneration. Diagnosis: Chorioepithelioma of the uterus.

The patient was discharged August 16 and has remained well since.

DR. A. P. C. ASHHURST said that in 1919, he reported to the Academy the case of a woman who was then well and healthy six years after a hysterectomy for chorioepithelioma. He had written her again and the letter was returned, marked removed, which did not seem to imply that she was dead. If she still lives it is now ten years since her operation. (NOTE.—Since this discussion, the patient has been traced by the Social Service Department of the Episcopal Hospital, and is in perfect health still.)

He thought it to be very important for anyone who has to evacuate the uterus after a miscarriage to have the tissue examined in the laboratory. In this case there was nothing grossly abnormal in the tissue, but the report from the laboratory came back in nine days and the next day the hysterectomy was done. Though this laboratory examination has been made as a routine since then in all cases, they have not found another case of chorioepithelioma, though such a diagnosis has been made twice erroneously from the gross specimen.

RAPID REGENERATION FOLLOWING FACIAL NERVE SUTURES

DR. E. L. ELIASON presented a woman who in the evening of April 11, 1923, sustained in an auto accident a jagged incised wound in front of the right ear extending from just above the tragus down to the angle of the mandible. This incision severed the facial nerve, the parotid gland and the masseter muscle. There was complete paralysis in the right facial nerve distribution. Other injuries to face, lip and teeth were present.

The wound was cleaned and the nerve which was severed just before it broke up into its division was sutured with 000 silk. The parotid was sutured and a small rubber wick placed in the lower angle of the wound.

April 17. She was discharged, wound having healed per primam. Facial paralysis still present.

April 30, 1923. A dentist who is at work on her teeth reports return of power to retract the angle of the mouth.

Neurological Report by Dr. George Wilson.—The first electrical reactions were made seventeen days after the injury and showed no reaction to faradism and reactions of degeneration to galvanism. Twenty-three days (May 4) after the accident there was a slight return of motion at the angle of the mouth and a strong faradic current produced slight reaction. She was treated with electricity, galvanism at first and later faradism two or three times a week until the first of September.

The return of power in the lower part of the face was quite rapid, but very little if any recovery has taken place in the upper branch of the seventh nerve. About the first of August she first began to show some movements in the lower part of the face when the eye was winked and

also movements of the eye when the lower part of the face was moved. This is probably due to the fact that some of the fibres in growing distally lose their way, those which should go to the upper part of the face going to the lower and those which should go to the lower part of the face going to the upper.

DR. CHARLES H. FRAZIER said that he was particularly interested in whether it was physically possible for nerve restoration to take place with return of function in twenty-four days. Estimating on the basis that nerve regeneration occurs at the rate of $1\frac{1}{2}$ cm. per week, it is quite possible for new axes to have grown down in this case from the point of injury to the end muscle within the specified time. A point which had occurred to him was whether or not it was possible to revise the laws of physical repair in cases of nerve injury because it is generally understood that after complete dissolution before regeneration takes place, degeneration takes place in the duct. If that were true it would hardly be conceivable that function could be restored within the specified time. He had no recollection of any other case which recovered as rapidly as this.

Concerning the return of function in the occipital frontalis, for some reason or other this frequently occurs.

DOCTOR ELIASON added that he had no especial difficulty except in finding the proximal end of the nerve. He put three fine silk sutures in it and obtained good approximation. There is no doubt about the fact that the nerve was cut, and that the return of function is authentic. Doctor Frazier had said he had never heard of a case being as rapid. Doctor Spiller, also, thought it very unusual, but said he had never heard of the facial nerve being sutured within one hour of the injury to it, and thought this might have something to do with the rapid regeneration.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY

Stated Meeting Held October 10, 1923

The President, DR. EUGENE H. POOL, in the Chair

PENETRATING ULCER OF THE LESSER CURVATURE OF THE STOMACH; BILLROTH II

DR. RICHARD LEWISOHN presented a man, thirty-nine years old, who was admitted to Mt. Sinai Hospital June 20, 1923. There was a two months' history of upper abdominal cramps and of nausea. There had been no vomiting. The Ewald test-meal showed free HCl 45, total acidity 83. X-ray examination showed a penetrating ulcer of the lesser curvature above the reëntrant angle.

Doctor Lewisohn stated that in ulcers situated in the proximal half of the stomach, it might be of importance to visualize, on the X-ray picture, the distance between the cardia and the ulcer. Although the usual X-ray picture outlines the stomach, it does not give any information as to the exact location of the cardiac opening. By using a nasal feeding tube, in combination with a ureteral X-ray bougie, he had been able in a number of cases to visualize the cardia on the röntgenogram.

At operation June 30, a small ulcer (size of a dime) was found. A subtotal gastrectomy was performed, from a point proximal to the ulcer to beyond the pylorus. Both ends were closed and stomach and jejunum were united by a Murphy button. The patient made an uneventful recovery. He was discharged July 24. The button was passed four weeks after the operation. Microscopic examination showed a benign ulcer. The patient has gained 35 pounds since his operation and feels perfectly well. The stomach empties so rapidly that it was impossible to get stomach contents for chemical analysis, though the tube was passed 30 minutes after the test-meal had been taken. X-ray examination (October 8) shows that the stomach empties rapidly; no residue after three hours.

DUODENAL ULCER; BILLROTH I

DOCTOR LEWISOHN presented a man, forty-two years old, who was admitted to Mt. Sinai Hospital July 23, 1923. He had suffered from intermittent epigastric pains for six years. These pains had become very severe during the last week before his admission. The pains were relieved by vomiting. Ewald free HCl 68, total acidity 89. There was some tenderness on pressure in the right epigastrium. X-ray examination showed an irregular duodenal cap, marked hyperperistalsis and a residue after six hours. Diagnosis: duodenal ulcer.

Operation (July 28) revealed a small thickened area in the first part of the duodenum on its anterior wall. The thickened area was about

one-half inch long. A crater could not be felt. A partial gastrectomy was performed, including the diseased area of the duodenum and about 8 cm. of the distal portion of the stomach. The two ends were reunited by using the Haberer modification of the Billroth I technic. The abdomen was closed without drainage.

Microscopic examination showed a superficial callous ulcer, not entirely healed. The patient made an uneventful recovery. Ewald test-meal taken sixteen days after the operation, showed free HCl 25, total acidity 66.

The patient was sent home three weeks after operation. He feels perfectly well now and has gained 11 pounds in six weeks.

X-ray examination (October 8) shows that the stomach empties rapidly; no residue after three hours.

PERFORATING GASTRIC ULCER

DR. HUGH AUCHINCLOSS presented a man, fifty years old, who had been treated for nine years in the Out-patient Department for supposed chronic pulmonary tuberculosis. He was a cigarmaker and smoked heavily. Didn't drink. For seven years he had had mild gastric symptoms. Attacks of epigastric discomfort and pain three to six hours after meals for two months at a time with free intervals of six or seven months, definitely worse during the past two years. He has had acid regurgitation and substernal burning. For two months has not only had a poor appetite, but has been afraid to eat, so that he has lost 15 pounds in two months and become very weak and discouraged. The stools have been dark for two weeks and for the past week he has vomited several times, brownish material, especially at night.

His first admission was on February 9, 1923, eight months ago. There was tenderness and visible peristalsis in the epigastrium. He had bad teeth, a short systolic murmur at his apex, but his lung signs were negative. There was a slight leucocytosis, 10,500, polymorphonuclears 78, and his red count showed 4,700,000. Haemoglobin 80. Wassermann negative. Blood urea .28 gms. per litre. Blood CO₂ 49 volumes per cent. Fasting expression showed blood; free HCl 50, total 95. Test meal, free HCl 57, total 67. A niche was described by Doctor Golden as present at the pylorus, probably on the gastric side, with persistent incisura opposite.

From February 9, he remained in the ward on a selected diet for twenty-four days. He lost his pain, all his symptoms disappeared, and he gained 12 pounds. He was advised to have an operation, but felt so well that he decided to go home on his own responsibility, signing a hospital release slip.

Three weeks later he reported at the Follow-up Clinic with no gastric symptoms, eating four meals a day as outlined for him by Doctor Bauman. He had gained about 15 pounds more, was working regularly and on the crest of the wave. A note made at that time states our conviction that he would have a recurrence. He was warned several times to report at once on the onset of pain or signs of hemorrhage.

PERFORATING GASTRIC ULCER

One morning, thirty-seven days later, he came to the Out-patient Department, having two days previously, slight epigastric discomfort. About six hours previously had awakened at 3 A.M., vomiting a very large amount of brown, sour, fluid described as at least two quarts. This was repeated in smaller amounts, up to 9 o'clock in the morning, when he came to the clinic. He was seen in the Emergency Ward by the House Surgeon, who found that there was slight tenderness, no rigidity, no evidence of free fluid, but leucocytes 18,200, polymorphonuclears 85 per cent. He was sent to the ward.

Just as he was being put to bed he began having very violent pain in right lower chest, epigastrium and right side of abdomen, much worse with motion, causing him to cry out and groan and beg for help. Rigidity and tenderness became evident, but the signs were not as diffuse as is generally seen. They were mostly in the right upper quadrant as in a localized peritonitis. There was a readily appreciated absence of liver dulness. The heart and breath sounds could not be heard over abdomen. On his way to the operating room, an effort was made to show an air shadow over the dome of the liver by taking an X-ray plate in as erect position as possible, but nothing was demonstrable.

He was operated on within an hour of his perforation. There was much air and brown fluid in the upper abdomen. Peritoneum was injected. An ulcer opening about .5 cm. in diameter with some induration about it appeared at the pylorus, it was thought on the gastric side. This was sutured with three Halsted mattress sutures taken from below upwards and then two from stomach to duodenum. A posterior short-loop gastro-enterostomy was done, suturing without clamps and a button jejuno-jejunostomy performed by inserting one-half the button in either limb when the jejunum was open during the gastro-enterostomy.

The post-operative course was uneventful. There was no pain, distention, vomiting or bleeding.

The Murphy button was lost in one of the enemata. It was seen by X-ray first on the seventh day, and again on the thirteenth day, over the sacrum, but was absent when plate was taken on the twenty-fifth day.

Four and one-half months later he weighed 128 pounds, and reports free of symptoms. The interesting features in this case are: 1. Nine years considered to have tuberculosis, whereas he had mild gastric disturbance seven years. When admitted, no active tuberculosis signs could be found. 2. Tenderness occurring on first admission as a suggestion that the ulcer was perforating. 3. Early loss of liver dulness. 4. Absence of heart and lung sounds over abdomen with perforation. 5. In mobility to demonstrate gas in peritoneum by X-ray after perforation, but before operation. 6. That he should have perforated under immediate observation while in the hospital, providing a somewhat exceptional opportunity for noting early physical signs and pathology.

Reëxamination of the stomach five months post-operative showed an apparently normally working gastro-enterostomy. No barium passed spontaneously through the pylorus. There was no six-hour gastric residue. The antrum seemed to close off quite well, but there was slight irregularity on the lesser curvature, apparently just above the pylorus,

which might be due to the crater of an ulcer. If this does represent an ulcer crater, it is very small, and looks nothing like what was seen at the previous examination. The duodenum was not satisfactorily seen, as little barium could be expressed through the pylorus.

FINNEY PYLOROPLASTY FOR PYLORIC STENOSIS

DR. JOHN C. A. GERSTER presented a man of thirty years, who was admitted to Mount Sinai Hospital, August 25, 1923. (Service of Dr. A. A. Berg.) There was epigastric distress for five years previously occurring one and one-half to three hours after meals, accompanied by nausea and pyrosis; no vomiting; lost 12 pounds in two years. Except for slight icteric tint, physical examination was negative. Ewald test meal of 6 ounces showed, 54 free acid; 70 combined acid. X-ray (August 27) showed increased peristalsis; duodenal bulb irregular at all observations; large residue after six hours; moderate residue after twenty-four hours. Wassermann negative. At operation (August 29) pyloric stenosis was found due to a stellate scar on anterior surface of first part of duodenum. Many adhesions around gall-bladder present. Typical Finney pyloroplasty. Uneventful convalescence except for congestion of right lower lobe for two days after operation. Discharged on the eighteenth day. October 8, forty days after operation, X-ray examination showed good tone and peristalsis. No residue at six hours. October 9, test meal showed free acid 58; combined acid 74. Has gained 18 pounds.

CASE II.—A man, thirty-eight years old, was admitted to Mount Sinai Hospital, April 20, 1923. (Service Dr. A. A. Berg.) He complained of stomach trouble for two or three years; a series of attacks of epigastric pain lasting a few days at a time and accompanied by pyrosis and vomiting had occurred. Between attacks he felt well. Last attack two weeks before admission. Lost 10 pounds in six months. Physical examination showed an emaciated, anæmic man with slight cyanosis. Otherwise physical examination was negative. X-ray examination April 23, showed extreme gastrocoloptosis. Duodenal bulb irregular at all observations. Increased peristalsis and slight delay in motility. Only one ounce of Ewald test meal was obtained. Free acid 5; combined acid 10. Wassermann negative. At operation, April 28, a small callous ulcer of anterior surface of first portion of duodenum, one-quarter of an inch in diameter, was excised in the course of a typical Finney operation. Discharged on the seventeenth day after operation. Specimen excised reported by pathologist to be a typical callous ulcer.

X-ray October 8, 1923, more than five months after operation, showed good gastric tone. Peristalsis not increased. At first, no food passed through opening for ten minutes, then it began to go through slowly. At six hours there was a small residue in the stomach; one-quarter of the meal in the ileum, the rest in colon. October 9, test meal showed free acid 45; combined acid 60. Has gained 12 pounds.

CASE III.—J. A., a man, forty-three years of age, was admitted to the Lenox Hill Hospital, July 4, 1922. (Service of Dr. DeWitt

CONGENITAL CYST OF THE COMMON BILE DUCT

Stetten.) He gave a history of twenty years' chronic indigestion with pain one hour after meals. In 1914, had a gastric hemorrhage. Four hours before admission, experienced sudden intense epigastric pain with vomiting. Physical examination showed a thin man with board-like rigidity of abdomen who evidently was suffering from acute perforation of the stomach. At operation, the perforation, 3 mm. in diameter on the anterior surface of the stomach near the pylorus, was closed with a silk mattress suture. Much free glairy fluid in the peritoneum with some gas; pelvis drained through a suprapubic stab wound. Uneventful convalescence. Discharged August 8. X-ray at that time showed marked ptosis. Stomach empty in six hours.

Re-admitted about one year later, August 11, 1923, stating that during the past few months there had been gradual development of pain after eating, vomiting of food eaten several days before; considerable loss of weight.

Physical examination revealed an emaciated man with a dilated stomach (clapottage) and a healed right rectus epigastric scar. August 14, X-ray examination showed 24-hour residue in stomach larger than immediate filling, probably due to admixture of food. Greater curvature of stomach in pelvis.

August 16, at operation, silk mattress suture found embedded in anterior wall of stomach at site of former perforation. No induration here. When stomach was opened in the course of pyloroplasty, mucosa at site of former perforation exposed and found normal.

September 5, stomach empty in three and one-half hours. Discharged same day, after uneventful convalescence.

October 10: Has gained 30 pounds since operation.

CONGENITAL CYST OF THE COMMON BILE DUCT

DR. RICHARD W. BOLLING presented a specimen of a congenital cyst of the common bile duct. The specimen was removed from a six months' female infant at autopsy, eighteen days after operation. The history was of normal birth and development until three months, when the mother noticed that the eyes were becoming yellow; the child, however, continued to nurse well and the stools were yellow or green. Shortly after an increase in the size of the abdomen was noted and the urine became very dark.

The child was admitted to Saint Luke's Hospital, June 19, 1923, when five months old, being referred to the pediatric service by Doctor Calhoun. During its stay in the hospital its stools varied in color from white to yellow or green, but in spite of repeated examination bile was never demonstrated. Shortly after admission Doctor Bolling saw the child in consultation and found an emaciated female infant with jaundiced scleræ. Occupying the upper abdomen was a globular cystic mass about three and one-half inches in diameter, extending downward from the under surface of the liver. The liver edge could be demonstrated above and the outline of the right kidney behind and to the outer side. Röntgen-ray examination made at this time showed a shadow of increased density occupying the right portion of the abdo-

men. The duodenum was apparently stretched over the summit of this mass and the small intestine and colon were displaced to the left. Lateral exposure showed the stomach extending anteriorly to the abdominal wall, lying almost at right angles to the spine.

The possibility of cyst of the common duct was suggested and operation advised, which was carried out July 6, after transfer to surgical division A.

A large cystic mass was found pushing forward the pyloric end of the stomach and the duodenum, which latter was stretched across the top of the cyst and flattened out like a ribbon. The gall-bladder appeared normal and communicated with the cyst by means of a patent cystic duct. No communication with the duodenum could be made out. The contents of the cyst, about sixteen ounces of yellow fluid, were evacuated and an anastomosis with the duodenum effected. The fluid gave a positive test for bile and contained much bile pigment. The wound was closed without drainage.

The child did well for ten days, but then began to fail, and died on the eighteenth post-operative day. Following the operation the stools varied in color from clay to green, but bile was never present. At autopsy the cyst was found much contracted and empty. The stoma was patent, but there had apparently been no secretion of bile. The condition of the liver evidenced an advanced state of biliary cirrhosis. The cyst consisted of a dilatation of the common duct. The openings of the hepatic and cystic ducts could be made out, but there was no demonstrable communication with the duodenum other than the artificial stoma made at operation. The opening of the pancreatic duct into the duodenum could be demonstrated.

The condition is one of considerable rarity. In an article in the *British Journal of Surgery*, in January of this year, Morley reports two cases and refers to thirty-nine in the literature. The condition usually occurs in females and the average age is twelve to fourteen years. An instance has been noted in the fœtus and one case is reported in a man of fifty-six who had had trouble since his twentieth year. The diagnosis is usually a matter of some difficulty. The rational treatment appears to be choledocho-duodenostomy without drainage.

ACUTE PERFORATED ULCER OF THE STOMACH AND DUODENUM

DR. JOHN A. MCCREERY read a paper with the above title, for which see page 91.

DR. CHARLES L. GIBSON admitted that the case for gastro-enterostomy is gaining adherents and that there are many people who can be benefited by this operation, but he felt that more of these cases of perforation would be saved if the surgeon confined himself to the immediate emergency. He believed that if 1000 cases were operated on by a simple procedure and 1000 by gastro-enterostomy, one case at least would die in the gastro-enterostomy series and this thousandth case was worth saving. He felt much as Panchet said: "If it is left to the patient he will prefer to be saved in two stages rather than to be killed in one." Nobody could lay

ACUTE PERFORATED ULCER OF THE STOMACH AND DUODENUM

down the law to experienced surgeons and many gastro-enterostomies were done wisely, but it had so happened that in the speaker's personal experience only one gastro-enterostomy had seemed necessary. It had been said this evening that he had reported, 10 per cent. of his cases required reoperation. He thought it fair to reply that if a surgeon has a relatively small primary mortality he will have more candidates for trouble. The question of how much stenosis is produced by the ulcer or cicatrization requires a little judgment. In many cases the stenosis involves only one side; it is not a circular contraction, and there is subsequent disappearance with the healing of the ulcer. The elimination of slough brings about the healing of the ulcer. Consequently, one should exercise a little discretion. Gastro-enterostomy in the body of the stomach does not result well and has some drawbacks.

DOCTOR GIBSON presented another argument, to wit: If a surgeon postpones operation he may be able to do a better, wiser, and more radical operation than gastro-enterostomy. The tendency of the times is for more and better surgery, and leaving an ulcer behind or doing an operation not involving the destruction of the ulcer is a confession of failure. Surgeons of great experience are now performing operations on duodenal ulcers that the speaker would not have believed possible a few years ago.

As to the question of referred pain, Doctor Gibson thought a history of it could often be elicited. He had seen patients with pain in the right shoulder; in one it was at the base of the neck. The elicitation of a history of this pain is interesting. It is short-lived, comes on early after perforation, lasts only a few minutes, and then goes away. Meanwhile the greater pain goes on and the patient forgets the lesser one. Recently, a patient who was asked about this clavicular pain denied it, but when convalescent he recalled having had the pain. The speaker believed this pain to be absolutely diagnostic.

DOCTOR GIBSON then described three technical procedures which he believes are of value:

1. Patient should be given a swallow of colored fluid, such as methylene blue, as this facilitates locating the perforation easily.
2. Opening the peritoneum under water. If a bubble of gas escapes the diagnosis becomes absolute.
3. When the application of sutures is likely to cause constriction, real or apparent, interrupted sutures are used and the line is made vertical to the axis of the duodenum or the pylorus (Heineke-Mikulicz technic). Constriction is reduced to a minimum.
4. Analysis of 78 cases shows the value of early operation. In the 18-hour period are included two cases that died of conditions independent of the operation: one a man who got out of bed the night after the operation, drank a lot of water and collapsed; temperature of 105° , oedema of lungs, and prompt death; autopsy showed an irreproachable condition. The second case died forty-five days after the original operation and twenty-three days

NEW YORK SURGICAL SOCIETY

after an operation for empyema; autopsy showed no connection with the abdominal condition.

SUMMARY OF SEVENTY-EIGHT CASES OF ACUTE PERFORATION OF STOMACH AND DUODENUM

Cases	Perforations	Deaths	Per cent.
	hours		
59	12	4	6.5 (3.2)
2	18		
5	24	1	20.0
12	Over 24	8	66.6
Total mortality, 16.6 per cent.			

DR. ALFRED STILLMAN said that in his personal cases absence of liver dulness had been frequent, and a distress more marked than in cases of appendicitis, amounting to shock, often suggested the diagnosis. About one-half of the cases closed had to be reopened; however, he preferred to close the peritoneal cavity without drainage.

DR. ROBERT T. MORRIS agreed with Doctor Gibson that one ought not to do more work than is actually necessary in these cases; he personally went a step further by simply making a short incision quickly, introducing a drain, putting the patient upon the Alonzo Clark opium treatment and then reserving further operative work for a more appropriate time with the patient in better condition.

Doctor Morris had arrived at this position in a natural sort of way. Forty years ago there were few surgeons outside of the big cities. Men from New York were more frequently called to long distances for cases of gastric or typhoid perforation. Sometimes the patients were dead, but sometimes they were better. These latter were the ones who had to be accounted for. Why were they better? The question of natural protective resources of the individual appeared. Carrying this idea to its logical conclusion. Doctor Morris who had formerly used the short incision and drainage tube in desperate cases only, moved up to the point of using this method in cases that were not so serious; with notably good results. Later he had done all of the modern operations—gastro-enterostomy, and partial gastrectomy. He had now gone back to the simplest, quickest drainage operation and to the Alonzo Clark opium treatment, reserving a severe operation for a later date and often finding it unnecessary.

Not quite enough had been said in this discussion about the persistence of original causes after operation for gastric ulcer. These must be looked for in focal infections or peripheral irritations and must be eliminated. For example, in the second case shown by Doctor Gerster, the patient was evidently suffering from heterophoria. The correction of heterophoria by a proper authority might result in complete disappearance of gastric or duodenal symptoms. Doctor Morris worked more and more in harmony with the internists in cases of midgut ulcer, doing less and less surgical work.

ACUTE PERFORATED ULCER OF THE STOMACH AND DUODENUM

DR. JOHN DOUGLAS said that the matter of what should be done in the way of more than closure of the perforation seemed to be the main question open to discussion. He believed that in most cases of perforated ulcer, closure of the perforation was all that should be done. But that if a surgeon starts an operation with the set and fast idea of what should be done in every case, he will not always get the best results. There are the late cases in which the mortality is always high and in which it is generally conceded one should do no more than close the perforation. In a few other cases it is still debatable if it is wiser to do more. In a small number it is possible to burn the ulcer out, then do a closure. Many of these patients have no further symptoms. But there are other cases in which the ulcer which is perforated is greatly indurated directly at the pylorus and can be closed only with difficulty and leaves considerable deformity and constriction. In these cases, if operation is done within the first few hours after perforation, when there is little peritoneal soiling and the patient's condition is good, a gastro-enterostomy can be done after closure with little if any increase of mortality and a far better prospect of cure of the patient. Doctor Gibson argues that if 1000 are closed with gastro-enterostomy and 1000 are closed without it, if there is one more death from the more complicated operation, the simpler operation should always be done. On the supposition that this is true, out of 1000 simple operations, 100 patients will have to be operated on again according to his statistics and far more according to the figures of Doctor McCreery, and as there is a mortality of about 3 per cent. following simple gastro-enterostomy from avoidable complications, the number of deaths from this second operation must be taken into consideration before accepting his reasoning.

As far as Doctor Lewisohn's case is concerned, Doctor Douglas could not see why three-fourths of the stomach should be taken out for an ulcer the size of a ten-cent piece. Burning out the ulcer with a cautery, followed by gastro-enterostomy would have given, he believed, good results. Simple excision in the second place would have given a good prospect of cure. Doctor Douglas did not consider that the criticisms of gastro-enterostomy were entirely justified. The follow-up clinic at St. Luke's did not show these bad results. As far as the Finney operation was concerned, Doctor Douglas believed that there were a number of cases where the induration and the extent of the ulcer made the Finney operation very difficult or impossible to do, but where the ulcer was close to the pylorus or a healed ulcer caused obstruction of the pylorus, it gave excellent results.

DR. WALTON MARTIN said he regarded statistical information as unsatisfactory as in many instances dissimilar cases were grouped together. It is the general experience, borne out by Doctor McCreery's series as in all others, that the time factor is of the utmost importance. He hardly thought Doctor McCreery would be in favor of gastro-enterostomy in the cases with well-established general peritonitis nor in favor of gastro-enterostomy in ulcer of the body of the stomach.

The question therefore was whether or no a gastro-enterostomy should be done in early cases of parapyloric perforation and Doctor Martin believes it rather confusing for Doctor McCreery to include cases outside this group and that it was slightly misleading to state in his resumé that gastro-enterostomy has not affected the mortality. It seemed fairer to state that gastro-enterostomy in suitably selected cases has not affected the mortality. This question, as many another in surgical practice, will always in the end hang on the individual judgment and disposition of the surgeon.

DR. EUGENE H. POOL said that a striking fallacy pervades all discussions in regard to gastro-enterostomy for perforated ulcers of duodenum. Namely, an evident impression in the minds of many surgeons that a gastro-enterostomy is a thoroughly reliable and harmless procedure. In reality it must be recognized that every patient with a gastro-enterostomy is handicapped. In about 20 per cent. of gastro-enterostomies symptomatic disturbances occur; and in two to three per cent. of cases a marginal ulcer develops. The latter condition is about as distressing to the patient and as troublesome from the operative point of view as is any gastric condition. One should therefore not feel that in adding a gastro-enterostomy a harmless procedure has been performed. A gastro-enterostomy should always be avoided if this can properly be done. It should not be performed because it can be safely carried out technically. Of course, in early cases where the inversion of the ulcer obstructs the pylorus, or in large callous ulcers, a primary gastro-enterostomy is indicated. But in the vast majority of cases closure of the ulcer will affect an immediate cure. If such cases are carefully watched after the operation, indications for gastro-enterostomy will develop in a considerable proportion on account of gradual pyloric obstruction. Gastro-enterostomy may then be done with relative safety and under definite indications. This appears better than subjecting all cases to gastro-enterostomy at the initial operation.

DOCTOR LEWISOHN, in concluding the discussion, said that in former years he had hesitated to sacrifice large parts of the stomach when the ulcer was very small. The final results following partial gastrectomies, however, had proven far superior to those following more conservative procedures in the treatment of gastric ulcers.

DOCTOR AUCHINCLOSS, answering a question regarding jejuno-jejunostomy, said he was not sure he had been right in doing this. So far, cases had done well where it had been used. It should be remembered that it was a procedure that made gastro-enterostomy successful in the "long-loop" days. He agreed with Doctor Pool that gastro-enterostomy was by no means a completely successful operation, even in duodenal ulcer cases. The speaker said he knows one well-known surgeon who has been doing antero-enterostomy in all his gastro-enterostomy cases for over fifteen years and believes it has lessened the follow-up discomforts in his cases. This, however, was rather contrary to the more recent notions as regards the alkalinity of the small

ACUTE PERFORATED ULCER OF THE STOMACH AND DUODENUM

intestine being of benefit when it gets into the stomach, which theory is not convincing and is a matter calling for further observations.

DOCTOR MCCREERY said that he fully agreed with Doctor Stillman that drainage was very rarely necessary in early cases and when used could usually be limited to drainage of the abdominal wall. Doctor Pool had spoken of the danger of the development of marginal ulcers following gastro-enterostomy. Doctor McCreery realized that marginal ulcer must always be borne in mind as a possible and, perhaps, the most serious complication of gastro-enterostomy. This had been emphasized by the fact that, during the period covered by the paper, two cases of acute perforated jejunal ulcer following gastro-enterostomy had been admitted to the division. However, he felt that there were two factors which should in future diminish the frequency of this complication. In the first place, the more accurate hæmostasis and separate mucous membrane suture made possible by operating without clamps, and in the second place a more careful control of the patient after his discharge from the hospital—with particular reference to diet, made possible by improved methods of follow-up. Doctor Douglas had emphasized the point which Doctor McCreery felt was of most interest, which was that each perforated ulcer should be considered as an individual problem. There was general agreement that nothing but closure should be done in late cases or for those in poor condition but in early cases there was considerable leeway. Unquestionably, many of the soft ulcers would be cured permanently by simple closure, but callous ulcers presented a different problem, and it was in these cases that a gastro-enterostomy or, possibly, an excision and pyloroplasty, should be considered in an effort to diminish the high percentage of secondary operations necessitated by simple routine closure of the perforation.

BOOK REVIEWS

CLEFT LIP AND PALATE. By TRUMAN W. BROPHY, M.D. P. Blakiston's Son and Co., Philadelphia, 1923.

In 1915, Doctor Brophy's Oral Surgery was published, and this contained his work on Cleft Lip and Palate. The present volume considers these two subjects alone, adding to his previous publication the results of more recent investigations and inventions, with the improvements in technic that have been made. One can only feel the greatest admiration for what Doctor Brophy has done in this difficult work with his immense experience.

The general apathy and ignorance of medical practitioners, in regard to this subject, is explained by Doctor Brophy to be due to the fact that in 1915, only six out of sixty-four leading medical colleges of our country had chairs on Oral Surgery. Patients with these lesions are usually referred to the General Surgeon, whose interest in them is as slight as his special knowledge of the defects to be corrected.

There should be special hospitals for these patients in all our centres, under the charge of an expert thoroughly familiar with the varying anatomical formations, and the necessary technic for correction. These lesions belong essentially to the specialist. The general practitioner will have to be educated along lines advocated by Doctor Brophy, whose views are more and more prevailing. The main object of closing a cleft palate is to obtain perfect speech; but how seldom this is obtained in the late operations, usually performed where the cleft has been allowed to widen, and the defect is only closed by soft parts. Doctor Brophy maintains that to obtain perfect speech, it is necessary, in very early life, to correct the spreading of the tuberosities of the superior maxilla, and that the defective speech is only secondarily due to the atrophy of the palatal muscles. The method to bring the bones together, at the earliest possible moment after birth, is Doctor Brophy's signal contribution to cleft palate surgery. This should be done, if the cleft of the palate is complete, before the fifth month while the bones are soft. Two months or later, after the union of the bones, the lip is united, and the soft palate is closed from the sixteenth to the twenty-second month, just before the child begins to talk. The very early closure of the cleft hard palate has been objected to by others, because of the alleged increased mortality due to the operation, but Doctor Brophy maintains that the death rate of children with unoperated, cleft palate is much higher than of children with normal palates, and that the deaths resulting from this operation, are less than this increase. Doctor Brophy's reasoning seems sound, and one can only explain the lack of enthusiasm on the part of the profession to embrace his views by the failure to apprehend the minutiae of the operation. It is a highly technical procedure. The obstetrical medical practitioner must be educated to send these little patients, just as early as possible after birth, to a surgeon who knows how to

BOOK REVIEWS

close the bones, according to the Brophy technic, and not wait for months, until the bones are thoroughly ossified, as is the customary procedure now. In a cleft lip with a cleft palate, the nose is always deformed, and, by first bringing the bones together, the nasal deformity is usually fairly corrected.

Before operating upon a cleft lip, after the hard palate has been closed, if the nose is broadened and flattened, it should be given its proper form by appropriate measures which are fully described and illustrated. Then follow descriptions of operations to cure the various types of cleft lip with explanatory pictures. Doctor Brophy says that hare lip is a misnomer because it does not resemble the lip of a hare whose cleft is in the median line. He prefers to call it cleft lip. He has eschewed all other methods, previously used, to prevent the separation of the sutured edges of the cleft lip, except Doctor Logan's lip traction bow which is described on page 24. With this appliance, tension on the lip may be increased or diminished at will, which is not possible with any other device. The procedures for closing cleft lips are simple and are fully described. Protruding, premaxillary bones should never under any condition, be excised. The vomer should be obliquely split and the premaxillary bone forced backward and held in place by silver wire sutures against the maxillæ. The edges of the premaxillary bone where they approximate the maxillæ, should have all the intervening soft parts removed, and the same is true of the maxillary bones. Non-union is due to the interposition of soft tissues and failure to immobilize. A normal, maxillary arch can be secured only by treating the parts in the same manner as one would an ununited fracture. Excision of the premaxillary bone leads to a very ugly deformity, recession of the upper lip, frequently combined with a marked contraction in width of the upper lip, in comparison with which, the lower lip seems to be relatively very prominent and thick. To correct this deformity a V-shaped portion of the lower lip is removed and added to the upper lip by means of a pedicle. This procedure is fully described and illustrated by photographs.

Among 2676 cleft palate operations performed by Doctor Brophy up to 1921, there were 125 deaths, or an operative mortality of only 4.67 per cent.

Brophy asserts, contrary to some others, that the bones in cleft palate are not defective in structure nor incomplete in development, but simply show abnormal elevation of the palate and failure of union, the cause of which is still under dispute.

He uses only lead plates, sutures of silver wire and horsehair in cleft palate operations. Brophy stresses the point that shock in a child under three months is much less severe than after that time. Very little anæsthetic is required in a child two weeks old, as the reviewer can testify from his own experience. Such a child seems insensitive, due to the fact that the central nervous system is yet non-medullated.

Brophy classifies fifteen forms of cleft palate with diagrams of each. The first six forms concern various types of cleft of the soft palate, and these may be closed at any time up to the period when the child begins to talk. Forms

BOOK REVIEWS

seven to fourteen inclusive concern clefts of the hard palate, and they should all be closed by moulding the bones together while they are still soft, preferably before two months. After five months it is impossible to bring the bones together by any technic. The only resource then is to cover the cleft with soft parts. Form fifteen is inoperable because the premaxillary bone is wanting, leaving a large notch in the anterior part of the palate which must so remain. The various operations on all the forms is clearly pictured so that he who reads may easily run. To accomplish these operations much patience and technical skill are required. The difficulty is that the general surgeon will usually not take the time to acquire knowledge of the necessary details, in consequence of which he frequently fails, condemning the method when it is his own shortcoming. Theoretically, Doctor Brophy is undoubtedly correct in his conception of the necessity of the very early moulding of the bones together in order to get perfect speech later on. The time is coming when every child with a cleft palate will be referred to the surgeon immediately after birth, and the surgeon, if he is conscientious, will have to learn the technic as so beautifully worked out by Doctor Brophy. Protruding premaxillary bones should never be removed, but should be displaced backwards so that the raw edges will be brought in contact with the raw edges on the maxillæ, where they will unite with these as would be the case, where they fractured. Among adults, Doctor Brophy considers, as inoperable, a patient in which there is an absence of tissue or one in which there is so little tissue that the construction of a hard palate surgically would be impossible even though we use the pharyngeal muscles, in which case a useful artificial palate should be made. Doctor Brophy has demonstrated without cavil that the beneficial result of the early operation is that it permits the normal development of the bones and consequently the function of speech which is the great desideratum. On page 214, he summarizes, in fourteen paragraphs, the advantages of his early operation. In adults the operation, as Brophy performs it, is not different from that customarily performed. The edges of the lifted-up mucoperiosteal flaps are sutured with horsehair and lead plates are put on the sides and held in place with silver wires as relaxation sutures. Lateral relaxation incisions in the hard palate are used, but for the purpose of relieving tension in the soft palate, no lateral incisions through the tensor palati, or any of the other palatal muscles, should be made as the function of the palate is permanently damaged thereby. On page 249, he gives eight reasons why lateral incision through the soft palate should not be made. When the palatal muscles are too short, Brophy has advised a brilliant procedure to lengthen the palate. He makes an incision (page 254) through two-thirds the width of the palato-pharyngeal muscle and adds this tissue to the end of the palate, thus securing a palate as long as one wishes. This increased length enables the palate to come in contact with the posterior pharyngeal wall. Doctor Brophy, through 1921, has done 5076 cleft palate operations, with 264 deaths, or 5.20 per cent. mortality.

The book has valuable chapters on Infant Feeding by Doctor Belknap,

BOOK REVIEWS

with supplementary suggestions in feeding Cleft Palate children by Doctor Brophy. There is a chapter on the Training of Speech after Cleft Palate Operation by G. Hudson-Makuen, and another on Eugenics, in which Doctor Brophy expresses his belief that heredity is a powerful influence in causing Cleft Lip and Palate, and that "in view of the conclusions reached by students of eugenics, I am satisfied that these defects are endemic." The book closes with an extensive bibliography, covering the time from Celsus to the present.

No surgeon who pretends to do cleft lip and palate operations can afford to be without this epoch-making book. It is a complete treatise on the subject, and no one need look further for a consideration of any phase of the subject. The reviewer can only express his admiration at the clearness of the descriptions of the various procedures, supplemented as they are so fully with 466 illustrations.

CLARENCE A. MCWILLIAMS.

DISEASES OF THE RECTUM AND COLON AND THEIR SURGICAL TREATMENT.

By P. LOCKHART MUMMERY, F.R.C.S., Eng., Senior Surgeon to St. Mark's Hospital for Cancer, Fistula, and Other Diseases of the Rectum, etc. New York. William Wood and Company, 1923.

The author clearly states in the preface that this book is not a revision of his former book on diseases of the rectum, because it seemed wiser to combine two volumes into one. This certainly is progressive and altruistic medical book-writing when we observe that throughout his text he has honestly adhered to that viewpoint.

To a reader familiar with books dealing with this specialty in medicine his thoroughness, broad knowledge and, above all, the expression of his frank personal opinions are most edifying and gratifying.

The volume not only presents a thorough and very liberal discussion of the medical and surgical treatment of rectal diseases, but also a most comprehensive treatise on the surgical treatment of the diseases of the entire colon. He thereby makes complete this knowledge, seldom described but necessary, in a text-book on the subject.

One is impressed by the author's familiarity with American medical literature on the diseases of the colon and rectum because of the numerous quotations and references which bear out this fact. This book is eminently serviceable as an international treatise that is broad enough in its views to include a recognition of American ability, which should be taken as a compliment by any reader in this country.

MARTIN L. BODKIN

CORRESPONDENCE

CRIPPLED JOINTS AND FLAT FEET

EDITOR ANNALS OF SURGERY:

Sir:

The most common orthopædic affections which have come my way have been attributed to "rheumatism," chronic arthritis and flat foot. The essence of the former and the existence of the latter were in ninety per cent. of the cases unheeded by the doctors who had been previously in attendance. An anomaly which, as a general surgeon, I can only assign to defective teaching or to ineptitude induced by the latest fizzle—iridized by the term "team work"—which unwittingly, in the first instance, eliminates the rudimentary maxim "look and see" and, in some quarters, is soothingly interpreted as "dud" to trouble about any detail examination until the germ finder, blood solver, ray reader and scatologist have given their verdict. Then arrives the psychological moment for clinical acumen and diagnostic wisdom.

I do not know of any advance during recent years in medical science of greater importance to the health of the community than the discovery that diseased teeth (frequently an unsuspected pus bag or latent septic root) are the usual cause of what is nothing more nor less than a form of pyæmic arthritis which gradually produces marked deformity.

During the past two years I have had four cases under treatment who were carried into hospital on a chair and appeared at first sight hopeless cripples—knee joints fixed in extreme flexion by "dry" arthritis. They had been previously under other medical treatment and in each—on admission—the mouth was a cess pit—carious teeth, vile stumps and foul gingivitis.

Within twelve months—after immediate removal of the putrid teeth followed by location in the "continuous outdoor," liberal feeding (with wine or stout), daily massage, and diathermy—these patients walked out of hospital with free movement in knee joints. A result, as viewed from the past, which almost admits of the term—miracle.

In many instances it is quite remarkable what a sudden subjective improvement follows in the general condition of the patient. I frequently hear within a week or so after the infected teeth have been got rid of, "I feel quite different." "I have not felt so well in myself for years," etc.

Rarely a day passes without my having to send some patient to a dentist with request, "If you cannot see anything suggestive of a septic focus, please have an X-ray photo taken." Occasionally I have had to change the dentist and photographer before finding it.

Flat Foot.—At a minimum calculation one patient per fortnight consults me for some condition of feet, ascribed by his medical attendant to gout or rheumatism, terms for which on examination I cannot find any meaning except as academic screens for scientific ignorance or for what is more perplexing, sheer laziness.

Invariably I ask such patients when your boot and sock were off, did

CORRESPONDENCE

your doctor request you to put your foot to the ground? The reply—10 to 1—is, "He did not." He failed even to observe the rule of a vet—"see a suspect limb in action."

Surely it is not asking too much of a man, even at peril of his being kicked out of "the team," to muster up sufficient energy as to beg of every patient who happens to consult him about a foot in which there is no obvious lesion, to remove the other boot and sock and take a few paces over the carpet.

By doing so I feel certain that patients would hear much more about correction of strain, the necessity for a pair of suitable boots and special exercises and a great deal less of what may be truly described as a disgrace to the term *Medicine*.

With all respect to that exalted mentality which takes pride in exclaiming—so that all may hear—"oh, I am sure I know nothing about that—first take him to the physician" or "to the nerve man"—I have in diagnostic quest, for many years, made it a practice to strip the patient—scan him anteriorly, posteriorly and laterally from the crown of his head to the soles of his feet and give a special glance, feel, ear or tap to the things I pass on the way.

Regardless of what people may think or say, I maintain (and shall continue doing so) that if the practice of medicine and surgery is to continue ranking as a profession, thorough clinical (detail) examination must always be made and diagnostic probability focussed by the physician or surgeon primarily in charge of the case before seeking what then becomes the inestimable aid of the experts previously mentioned, without whose assistance our work to-day would be an anachronism.

JOHN O'CONOR, M.D.,
Buenos Aires, Argentina.

THE TOXINS OF PREGNANCY AND GALL-BLADDER DISEASE IN THE FŒTUS

EDITOR, ANNALS OF SURGERY:

Sir:

I was much interested in Doctor Kellogg's article on "Gall-bladder Disease in Childhood" (*ANNALS OF SURGERY*, May, 1923). There is in this his usual carefully guarded statements which are much admired. The significance of his summary is to me important.

The statement that "cholelithiasis in the newborn appears to be due to an unknown foetal pathology and is usually fatal," is quite in line with my studies, and the author's statement that in acute "infections" of the gall-bladder "no other infection could be found," shows the dilemma in which the clinicians find themselves. The same factors that produce cholelithiasis and cholecystitis in the foetus are found to be at work in the adult. In our researches on the toxins of pregnancy from tissue breakdown, it was found that no other toxin produced the pathological changes in the mother or offspring. This toxin is the cell substance itself freed by disintegration from the cell, and is, therefore, appropriately termed cytost. In these researches we have made (over 1000 animals) on mother and offspring with cytost

CORRESPONDENCE

reaction, all varieties of cholecystitis were shown—with and without stones. This pathology of the bile channels is only incidental to other changes produced by tissue toxin cyto-st. The early acute reaction found in the liver beginning in the bile ducts in the portal zone was observed by me as early as 1903 when experimenting with what I then termed "shock toxin," now known as cyto-st. The repeated observations on these fundamental biological changes which I have reported in over 100 publications, ought to make it easy to trace the clinical findings and the origin of these changes in the liver. This is especially so, since Limousin of Pasteur Institute, Prof. Henri Hartmann and Professor Jeanneney (of the Universit  de Bordeaux) have verified this work. It seems incredible that the clinical mind must remain contented with a statistical and symptomatic explanation when well-known biological principles are so well established. Unless it can be agreed that fundamental knowledge is only acquired by experimental research, no further discussion is profitable. Empiricism and pure assumption for the explanation of biological phenomena is no longer tenable.

The "unknown foetal pathology" which the author refers to has been the subject of much research by biologists on the egg cell and embryo. In this all the reactions were found to be due to the action of the cell substance itself on the living cells. In low concentration cyto-st acts as a cell stimulant, excites cell division, growth and increased metabolism. In high concentration of cyto-st the opposite condition is produced—morbidity and death.

This is quite in line with empirical experience. That which stimulates in low concentration causes disintegration in high concentration. It is not difficult to follow as the embryo develops into a foetus the same law continues. Be that as it may, the twenty-five years of research which I have conducted on the principle of cyto-st reaction and their results which have been reported in over 100 publications, has received full verification by biologists working in similar lines. As concrete evidence I might refer you to Limousin's recent report of this work (*Jour. Medicale Francais*, June, 1923, pp. 238-40). This brochure contains full laboratory verification, also clinical observations which he had delegated to others at the Pasteur Institute. The French are among the most able critics in science, as well as art, and if authority is all that is needed, it will be found here.

Doctor Kellogg's excellent report should stimulate the most rigid investigation of the biological reactions which occur in the pregnant state, and note that similar reactions occur in the non-pregnant state.

FENTON B. TURCK, M.D.,
New York City.

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